PROCEEDINGS

OF

THE CHEMICAL SOCIETY.

Vol. XXVII. Nos. 380—394.
JANUARY—DECEMBER, 1911.

LONDON:
GURNEY & JACKSON, 10, PATERNOSTER ROW.
1912.

RICHARD CLAY AND SONS, LIMITED
BRUNSWICK ST., STAMFORD ST., S.E., AND
BUNGAY SUFFOLK

540.6 C42
v. 27-28

LIST OF GRANTS MADE FROM THE RESEARCH FUND DURING THE YEAR 1911.

£10 to E. C. C. Baly: the relation between absorption spectra and chemical activity (continued).

£10 to O. L. Brady: constitution of aconitine.

£5 to A. T. Cameron: physical and chemical properties of crystallised protein.

£10 to A. Campion: properties of the different forms of carbon and carbon compounds existing in iron and, more especially, cast iron.

£10 to D. Cardwell: synthesis of *apo*harmin.

£5 to F. W. Caton: absorption spectra of 2:3-diphenylpyrazines.

£10 to F. D. Chattaway: polymorphism among hydrazides and anilides.

£10 to A. Clayton: a comparison of the function of the oxygen and sulphur atoms in lactones and thiolactones.

£5 to Miss G. Cliffe: action of Grignard's reagents on β-chloropropionic ester and on amyloxypropionic ester.

£8 to T. Q. Chou: preparation of *iso*quinoline derivatives.

£10 to H. M. Dawson: dynamics of intramolecular change.

£5 to C. Dorée: constitution of cholesterol.

£7 to A. C. Dunningham: equilibria of partially miscible liquids.

£10 to J. Ferns: reactions of some derivatives of sulphonic acids.

£3 to C. H. Hampshire: constitution of picrotoxin.

£10 to R. T. Hardman: electromotive forces in alcohol.

£10 to T. P. Hilditch: quantitative nature of molecular rotatory power in normal homologous series.

£10 to E. Hope: condensation of cotarnine with other nitro-compounds.

£15 to E. Hope: condensation products of cotarnine with certain ketones, imines, and hydrocarbons.

£10 to A. Hopwood: the synthesis of naphthyltyrosine and of the polypeptides of tyrosine. The action of ferments on the polypeptides of higher fatty acids.

£22 10. to T. E. Hull: annealing and heat treatment of steels.

£5 to T. C. James: iodocinnamic acids. The addition of halogens to compounds containing a double bond between carbon and nitrogen.

£5 to J. Kenner: synthesis of phenanthrene.

£12 to F. R. Lankshear: epicamphor.
£10 to T. M. Lowry: dynamic isomerism.
£10 to J. W. McBain: constitution of soap solutions.
£10 to J. W. McDavid: synthesis of harmin.
£5 to A. N. Meldrum: synthesis of substances related to cochenillic and carminic acids
£5 to J. E. Myers and J. B. Firth: action of sodium hyposulphite on copper sulphate.
£10 to W. Parry: action of Grignard's reagents on ethyl-a-hydroxy-a-ethylbutyrate.
£10 to R. S. Pollard: synthesis of substances allied to cotarnine.
£15 to J. N. Pring: reduction of refractory oxides by hydrogen at high temperatures.
£15 to W. M. Roberts: synthesis of pseudo-opianic acid. Derivatives obtained by the action of mixed organo-metallic compounds on esters of higher fatty dibasic acids.
£25 to R. Robinson: synthesis of *iso*quinoline alkaloids.
£5 to D. Segaller: the velocity-coefficients of some iodo-compounds with sodium phenoxide in alcoholic solution at various temperatures.
£5 to R. E. Slade: use of the hydrogen electrode in determining the dissociation constants of acids and bases.
£8 to Miss I. Smedley: constitution of the higher fatty acids.
£10 to S. Smith: tribromoxylenols.
£5 to F. B. Thole: relation between the residual affinity of liquids and their dissociating influence on associated solutes.
£8 to H. T. Tizard: ionisation constant of water at different temperatures.
£8 to W. E. S. Turner: solubilities of salts.
£12 to D. Tyrer; several important problems in physical chemistry.

Total amount granted during 1911 = £393. 10. 0.

LIST OF FELLOWS ELECTED DURING 1911.

Name.	Proposed.	Elected.
Acree, Solomon Farley	January 19th, 1911	February 16th.
Adendorff, John Ernest Roux	March 16th, 1911	May 4th.
Allan, James, M.A., B.Sc.	December 15th, 1910	February 16th.
Anderson, Edward	November 17th, 1910	,, ,,
Ashe, Albert	December 1st, 1910	,, ,,
Atkins, Ernest Andrew	April 6th, 1911	June 15th.
Atkinson, Norman Ernest	May 18th, 1911	,, ,,
Auld, Samuel James Manson, D.Sc., Ph.D.	February 16th, 1911	May 4th.
Barbary, John Ewart Trounce	January 19th, 1911	February 16th.
Bate, Joseph	December 15th, 1910	,, ,,
Bennison, Ernest Carr	March 16th, 1911	May 4th.
Bescoby, Arthur Cecil, B.A.	October 19th, 1911	December 7th.
Blackburn, Joseph Mayson	December 15th, 1910	February 16th.
Blackhurst Arthur Owen	May 4th, 1911	June 15th.
Bowden, Richard Charles, B.Sc.	March 16th, 1911	May 4th.
Bowyer, Arthur Stewart, M.Sc.	February 16th, 1911	,, ,,
Bradshaw, George Arthur, M.Sc.	April 6th, 1911	June 15th.
Bull, Bertram Alfred	October 19th, 1911	December 7th.
Bull, Joseph Beauchamp	,, ,, ,,	,, ,,
Burbridge, Walter Norman	November 17th, 1910	February 16th.
Carmichael, John Fisher, B.Sc.	November 17th, 1910	February 16th.
Charlton, Edwin Johnson, M.Sc.	October 19th, 1911	December 7th.
Christopher, Harold, B.Sc.	January 19th, 1911	February 16th.
Clarke, Arthur Frederick	April 6th, 1911	June 15th.
Collington, John Eric	February 2nd, 1911	May 4th.
Cooke, Charles Ernest	April 6th, 1911	June 15th.
Cowling, Thomas	May 18th, 1911	,,
Crook, Clement Arthur	February 2nd, 1911	May 4th.
Cutner, Morris, B.Sc.	December 1st, 1910	February 16th.
Crymble, Cecil Reginald, B.Se.	February 16th, 1911	May 4th.
Datta, Atulchandra, M.A.	March 16th, 1911	May 4th.
Datta, Ganesh, B.A.	May 4th, 1911	June 15th.
Demuth, Rudolph	,, 18th, 1911	,, ,,
Devlin, James Edward A.	December 1st, 1910	February 16th.
Dickinson, William Henry, M.B., Ch.B.	February 2nd, 1911	May 4th.
Douse, Oliver Statham, B.Sc.	,, 16th, 1911	,, ,,
Dryden, Harold Edgar	January 19th, 1911	February 16th.
Dutt, Barun Chandra, M.A.	October 19th, 1911	December 7th.
Eardley, James Furnival	January 19th, 1911	February 16th.
Eggington, Alfred Thomas, B.Sc.	March 2nd, 1911	May 4th.
Eldridge, Arthur Alfred, B.Sc.	,, ,, ,,	,, ,,
Elkington, Algernon John	,, 16th, 1911	,, ,,
Emerson, Robert Leonard, A.B., M.D.	January 19th, 1911	February 16th.

Name.	Proposed.	Elected.
Empson, Alfred Walker	March 16th, 1911	May 4th.
Enfield, Ralph Roscoe, B.A.	February 2nd, 1911	,, ,,
Fielding, Michael Angelo	December 15th, 1910	February 16th.
Gallsworthy, Benjamin	May 18th, 1911	June 15th.
Gardner, Edgar Harold	April 6th, 1911	,, ,,
Gardner, William Temple	December 1st, 1910	February 16th.
Gardthausen, Charles Christian	November 16th, 1911	December 7th.
Garner, John Henry, B.Sc.	,, 2nd, 1911	,, ,,
Gauge, Arthur Josiah Hoffmeister	October 19th, 1911	,, ,,
Gaunt, Rufus, M.Sc., Ph D.	November 2nd, 1911	,, ,,
Ghose, Joges Chandra, M.A.	May 4th, 1911	June 15th.
Giddy, Thomas Grantham	March 16th, 1911	May 4th.
Gonville, Cyril Herbert Koszelski	May 18th, 1911	June 15th.
Goold, Rowland Lewis	April 6th, 1911	,, ,,
Griffiths, Evan Dalton, B.Sc.	December 15th, 1910	February 16th.
Hall, Arthur Bennett	December 15th, 1910	February 16th.
Hall, Sydney, B.Sc.	October 19th, 1911	December 7th.
Hampshire, Charles Herbert, B.Sc.	December 15th, 1910	February 16th.
Harding, Henry George Alan	November 17th, 1910	,, ,,
Harwood, Henry Francis, M.Sc., Ph.D.	February 16th, 1911	May 4th.
Hill, James Hogan	November 16th, 1911	December 7th.
Hodgson, Cyril Vincent	October 19th, 1911	,, ,,
Hodsman, Henry James, M.Sc.	,, ,, ,,	,, ,,
Hogg, Alexander Frederick, M.A.	,, ,, ,,	,, ,,
Horne, William Joseph Chetwynd	January 19th, 1911	February 16th.
Hough, Bernard Grindrod	December 15th, 1910	,, ,,
Hughes, Edwin Burnhope	March 2nd, 1911	May 4th.
Hurst, Reginald	January 19th, 1911	February 16th.
Jenkin, William Alfred	November 17th, 1910	February 16th
Joseph, Edward Lionel	April 6th, 1911	June 15th.
Khosla, Sant Ram	November 2nd, 1911	December 7th.
King, Harold, M.Sc.	,, ,, ,,	,, ,,
Laws, Ernyst Graham, B.A.	December 15th, 1910	February 16th.
Linenbröker, Henry Edmund	May 18th, 1911	June 15th.
Ling, Herbert James	,, 4th, 1911	,, ,,
Lucas, Thomas Riley	February 16th, 1911	May 4th.
McBain, James William, M.A., Ph.D.	January 19th, 1911	February 16th.
Martin, Geoffrey, M.Sc., Ph.D.	November 2nd, 1911	December 7th.
Merriman, Richard William, M.A.	April 6th, 1911	June 15th.
Messervy, Roney Forshaw	February 16th, 1911	May 4th.
Miller, John Watterson	November 17th, 1910	February 16th.
Mills, Robert	October 19th, 1911	December 7th.
Moore, Walter Roman	November 17th, 1910	February 16th.
Moullin, Oswald Mansell-, B.A.	February 2nd, 1911	May 4th.
Nath, Bhâgavatula Viswa	October 19th, 1911	December 7th.
Newton, Leonard Owen	March 2nd, 1911	May 4th.
Nilié-Martin, Gaston	November 16th, 1911	December 7th.

Name.	Proposed.	Elected.
Owen, Idris Larkby, M.Sc.	March 16th, 1911	May 4th.
Page, Harold James	December 1st, 1910	February 16th.
Parkes, Thomas Peers, B.Sc.	October 19th, 1911	December 7th.
Partington, Edward	January 19th, 1911	February 16th.
Pastfield, John Lawrence Robinson, B.A.	February 16th, 1911	May 4th.
Paul, Felix Gabriel	May 4th, 1911	June 15th.
Peacock, David Henry, B.A., B.Sc.	October 19th, 1911	December 7th.
Peddle, Cyril James, M.Sc.	January 19th, 1911	February 16th.
Penney, Richard Garnet	February 16th, 1911	May 4th.
Percival, George Arnliffe	,, 2nd, 1911	,, ,,
Pitt, Leonard Ison, B.Sc.	May 18th, 1911	June 15th.
Plews, Frank Henry	November 17th, 1910	February 16th.
Rao, B. Venkata, B.A.	October 19th, 1911	December 7th.
Raper, Henry Stanley	November 17th, 1910	February 16th.
Raymond, Percy James	June 1st, 1911	December 7th.
Reilly, Joseph, B.A.	October 19th, 1911	,, ,,
Richardson, John Ffraid	November 16th, 1911	,, ,,
Ridsdale, Noël Douglas	October 19th, 1911	,, ,,
Rivett, Albert Cherbury David, B.A., B.Sc.	February 2nd, 1911	May 4th.
Robison, Robert, Ph.D., B.Sc.	March 16th, 1911	,, ,,
Saville, William Bristow	October 19th, 1911	December 7th.
Scopes, Lionel Gowing	June 15th, 1911	,, ,,
Smith, Bernard Charlie	October 19th, 1911	,, ,,
Smith, John Henry	,, ,, ,,	,, ,,
Stanford, Robert Viner, M.Sc., Ph.D.	December 1st, 1910	February 16th
Stokes, George Alfred	November 2nd, 1911	December 7th.
Summers, George Douglas	,, 17th, 1910	February 16th.
Thomson, David, M.A., B.Sc., Ph.D.	January 19th, 1911	February 16th.
Vakil, Kapibram Hardevram, B.A.	October 19th, 1911	December 7th.
Vanstone, Ernest, B.Sc.	June 1st, 1911	,, ,,
Vassiliev, Alexey, Mikhailovich	November 16th, 1911	,, ,,
Verschoyle, William Denham	January 19th, 1911	February 16th.
Vipond, Harry James, B.A.	October 19th, 1911	December 7th.
Walker, Eric Everard	March 2nd, 1911	May 4th.
Walton, William Keighley	May 4th, 1911	June 15th.
Watson, Henry Hough	March 2nd, 1911	May 4th.
Waygood, Bertie James	January 19th, 1911	February 16th.
Wheldon, Alfred Henry Finniss	February 16th, 1911	May 4th.
Wilks, William Arthur Reginald, M.A.	,, 2nd, 1911	,, ,,
Wink, Ian Gordon Sellar	December 15th, 1910	February 16th.
Wishart, George, B.A.	June 15th, 1911	December 7th.
Wood, Edward Escott	January 19th, 1911	February 16th.
Wood, William	March 2nd, 1911	May 4th.
Wright, Ernest Walter	October 19th, 1911	December 7th.
Wright, Robert, M.A.	February 16th, 1911	May 4th.
Yates, Charles Fursdon	January 19th, 1911	February 16th.

LIST OT HONORARY AND FOREIGN MEMBERS ELECTED DURING 1911.

Name.	Proposed.	Elected.
Eugen Bamberger	February 16th, 1911	March 2nd.
Giacomo Ciamician	,, ,, ,,	,, ,,
Paul Heinrich Ritter von Groth	,, ,, ,,	,, ,,
John William Mallet	,, ,, ,,	,, ,,
Walther Nernst	,, ,, ,,	,, ,,

LIST OF FELLOWS DECEASED DURING 1911.

Name.	Elected.	Died.
* [1] Attfield, John	January 16th, 1862	March 18th, 1911.
Beanes, Edward	March 3rd, 1864	August 19th, 1911.
Braby, Frederic	April 15th, 1869	October 9th, 1911.
Brown, Joseph	March 16th, 1882	June 2nd, 1911.
*Buch, Carl von	June 21st, 1877	April 23rd, 1911.
Collens, Edward	November 6th, 1873	April 12th, 1911.
Cooper, Albert	January 17th, 1889	August 19th, 1911.
Darby, Stephen	November 15th, 1852	December 21st, 1911.
*Davis, Richard Hayton	June 6th, 1872	June 2nd, 1911.
Ferrier, John Greig	May 4th, 1905	February 14th, 1911.
Forbes, James	November 19th, 1874	March 14th, 1911.
Harrison, Albert	May 17th, 1888	August 28th, 1911.
Hoit, Alfred Henry	February 17th, 1904	December 22nd, 1911.
Hudson, William	February 21st, 1878	February 23rd, 1911.
Kinnicutt, Leonard Parker	December 5th, 1895	February 6th, 1911.
Knight, Frederick Charles	June 20th, 1889	February 12th, 1911.
Lyon, Isidore Bernadotte	May 1st, 1873	April 27th, 1911.
McCowan, William	February 4th, 1875	March 4th, 1911.
* [2] Maskelyne, Mervyn Herbert Nevil Story	June 2nd, 1851	May 20th, 1911.
*Muter, John	November 3rd, 1870	December 19th, 1911
*Nevile, Ralph Henry Christopher	April 4th, 1878	March 9th, 1911.
Orme, Temple Augustus	November 4th, 1869	April 4th, 1911.
Ross, Lewis Buttle	February 17th, 1870	December 5th, 1911.
Sadler, Sir Samuel	June 18th, 1868	September 29th, 1911.
Sharp, James	June 18th, 1885	May 11th, 1911.
Smith, Harry Wood	February 6th, 1890	February 10th, 1911.
Walker, James Samuel Hourston	April 17th, 1890	November 19th, 1910.
Whitehouse, William	December 5th, 1889	June 16th, 1911.
Williams, William	December 15th, 1892	February 16th, 1911.
*Winterson, William George	December 3rd, 1908	May 18th, 1911.

LIST OF HONORARY AND FOREIGN MEMBERS DECEASED DURING 1911.

van't Hoff, Jacobus Heinricus	February 2nd, 1888	March 1st, 1911.
Ladenburg, Albert	,, ,, ,,	August 15th, 1911.
Spring, Walthère	January 20th, 1898	July 17th, 1911.
Troost, Louis Joseph	,, ,, ,,	September 30th, 1911

* Trans. [1] C. 1874–8. [2] C. 1858–9; 1875–7. V.P. 1878–81.

TITLES OF PAPERS COMMUNICATED TO THE SOCIETY DURING 1911.

	Page in Proceedings.	Page in Transactions.
January 19th.		
1. The interaction of alloxan and glycine. By William Holdsworth Hurtley and William Ord Wootton	2	288
2. Intramolecular rearrangements of diphenylmethane *o*-sulphoxide. By Thomas Percy Hilditch and Samuel Smiles	3	145
3. The reactions between chemical compounds and living muscle-proteins. By Victor Herbert Veley	3	180
4. The decomposition of tetramethylammonium nitrite by heat. By Prafulla Chandra Rây and Hemendra Kumar Sen	4	—
5. Influence of minute quantities of ferric salts and of manganese nitrate on the rate of solution of mercury in nitric acid. By Prafulla Chandra Rây	4	1012
6. On *d*- and *d*-Δ^2-*m*-menthenol(8) and *dl*- and *d*-$\Delta^{2:8(9)}$-*m*-menthadiene. By Walter Norman Haworth, William Henry Perkin, jun., and Otto Wallach	4	118
7. The identity of xanthaline and papaveraldine. By Bessie Dobson and William Henry Perkin, jun.	4	135
8. Amalgams containing silver and tin. By Reginald Arthur Joyner	5	195
9. Studies of the constitution of soaps in solution. The electrical conductivity of sodium stearate solutions. By Richard Charles Bowden	5	191
10. Additive compounds of phenols and phenolic ethers with aromatic polynitro-derivatives. By John Joseph Sudborough and Stanley Hoskings Beard	5	209
11. The effect of contiguous unsaturated groups on optical activity. Part VI. The influence of the carbonyl group on optical rotatory power. Part VII. The relative influences of aromatic and hydroaromatic nuclei on optical rotatory power. Part VIII. The influence on optical activity of two contiguous unsaturated groups in comparison with that of one unsaturated group at varying distances from the optically active complex. By Thomas Percy Hilditch	6	224
12. The relative effects of ethylenic and acetylenic linkings on optical rotatory power. By Thomas Percy Hilditch	6	218
13. The direct action of radium on ammonia. By Edgar Philip Perman	7	132
14. Cupritartrates and analogous compounds. By Spencer Umfreville Pickering	7	169

	Page in Proceedings.	Page in Transactions.
15. Molecular association in water. By Cyril James Peddle and William Ernest Stephen Turner	8	685
16. Note on the preparation of thiobenzanilide. By Edward de Barry Barnett	8	—
17. Organic derivatives of silicon. Part XIV. The preparation of tertiary silicols. By Frederic Stanley Kipping and John Edward Hackford	8	138
18. *o*-Carboxyanilides of the sugars. By James Colquhoun Irvine and Alexander Hynd	9	161
19. The iodobenzenemonosulphonic acids. Part III. 2:3-Di-iodo- and 2:3:4:5-tetraiodo-benzenesulphonic acids. By Mary Boyle	9	325
20. Occurrence of pentathionic acid in natural waters. By James Scott Maclaurin	10	—
21. β-Methyl-$\Delta^{\alpha\lambda}$-dodecadiene and β-methyl-$\Delta^{\alpha\gamma}$-decadiene. By Victor John Harding, Gertrude Maud Walsh, and Charles Weizmann	12	448
22. Determination of the vapour pressures of hydrates by a dynamical method. (Preliminary note.) By James Riddick Partington	12	—
23. A simple demonstration of Gibbs's phase rule. By James Riddick Partington	13	—
24. Cholesterol and fatty acids. By James Riddick Partington	14	313
25. Salts of the dinitrodihydroxybenzenes. By William Bayliss Shaw	14	—
February 2nd.		
26. The constancy of water of crystallisation in hydrated salts. Part I. By Herbert Brereton Baker and George Henry Joseph Adlam	17	507
27. The triazo-group. Part XVI. Interaction of nitrosates and sodium azide. By Martin Onslow Forster and Frederik Marinus van Gelderen	19	239
28. The triazo-group. Part XVII. Nitroso-azides of pinene and terpineol. By Martin Onslow Forster and Sidney Herbert Newman	19	244
29. The synthesis of 3-β-aminoethylindole. By Arthur James Ewins	20	270
30. The orientation of the nitro-group in nitromyristicinic acid. By Arthur Henry Salway	20	266
31. The condensation of aromatic aldehydes with nitromethane. By Frederic George Percy Remfry	20	282
32. The phosphoric acids. By Alfred Holt and James Eckersley Myers	21	384
33. The determination of solubility coefficients by aspiration By William Jacob Jones	21	392
34. α-Amino-α-phenylacetamide and some of its derivatives. By Charles Hugh Clarke and Francis Francis	22	319
35. Methylammonium nitrite. By Prafulla Chandra Rây and Jitendra Nath Rakshit	22	1016

	Page in Proceedings.	Page in Transactions.
36. The picraminobenzoic acids and their salts. By James Codrington Crocker and Frank Matthews	22	301
37. New derivatives of *d*-glucosamine. By James Colquhoun Irvine, David McNicoll, and Alexander Hynd	23	259
38. The interaction of silver nitrate and potassium persulphate and its catalytic effect in the oxidation of organic substances. By Percy Corlett Austin	24	262
39. The isomerism of ferrocyanides. By Samuel Henry Clifford Briggs	24	1019
February 16th.		
40. Different methods of applying the Grignard reagents. By Harold Davies and Frederic Stanley Kipping	39	296
41. Molecular association and its relationship to electrolytic dissociation. The molecular complexity of halogen-containing compounds. By William Ernest Stephen Turner	40	880
42. α-*p*-Hydroxy-*m*-methoxyphenylethylamine, and the resolution of α-*p*-hydroxyphenylethylamine. By Charles Watson Moore	42	416
43. The formation and reactions of imino-compounds. Part XV. The production of imino-derivatives of piperidine leading to the formation of the ββ-disubstituted glutaric acids. By Ferdinand Bernard Thole and Jocelyn Field Thorpe	42	422
44. The interaction of copper und nitric acid in presence of metallic nitrates. Part II. By Edward Henry Rennie and William Ternent Cooke	42	1035
45. The mechanism of Doebner and von Miller's quinaldine synthesis. By Humphrey Owen Jones and Percy Edwin Evans	43	334
46. A synthesis of derivatives of phenothioxin. By Thomas Percy Hilditch and Samuel Smiles	44	408
47. The nitration of acetylbenzoin and of stilbenediol diacetates. By Arthur Gordon Francis and Charles Alexander Keane	44	344
48. Experiments on the formation of 4(or 5)-β-aminoethylglyoxaline from histidine. By Arthur James Ewins and Frank Lee Pyman	45	339
49. The dissociation of cupric bromide, and some forms of glass manometer. By Colin Gyrth Jackson	45	1066
50. The determination of the dissociation pressures of hydrated salts by a dynamical method. By James Riddick Partington	45	466
51. The influence of conjugated linkings on general absorptive power. Part I. The absorption spectra of some benzene derivatives. By Cecil Reginald Crymble, Alfred Walter Stewart, Robert Wright, and William Gerald Glendinning	46	451

	Page in Proceedings.	Page in Transactions.
52. The optical properties of acids containing an asymmetric quaternary carbon atom. Part I. The synthesis of β-phenyl-β-methylvaleric acid and of *as*-methylethylsuccinic acid. By John Kenneth Harold Inglis	46	538
March 2nd.		
53. Studies in the camphane series. Part XXIX. A new phenylhydrazone of camphorquinone. By Martin Onslow Forster and Adolf Zimmerli	50	478
54. Fluorone derivatives. By Frank George Pope and Hubert Howard	52	545
55. The constituents of *Withania somnifera*. By Frederick Belding Power and Arthur Henry Salway	53	490
56. The carbohydrate constituents of Pára rubber: separation of *l*-methylinositol. (Preliminary note.) By Samuel Shrowder Pickles and Bernard Wyndham Whitfeild	54	—
57. Potassium cupricarbonates. By S. U. Pickering	55	800
58. Synthesis of dipeptides of α-aminolauric acid with glycine, alanine, valine, leucine, and asparagine. By Arthur Hopwood and Charles Weizmann	55	571
59. The occlusion of hydrogen by the palladium-gold alloys. By Arthur John Berry	56	463
60. Synthesis of *dl*-3 : 4-dihydroxyphenylalanine. By Casimir Funk	56	554
61. The interaction of chlorine and carbon monoxide. (Preliminary note.) By David Leonard Chapman and Frank Houghton Gee	56	—
62. Experiments on the synthesis of the terpenes. Part XVI. Resolution of *dl*-1-methyl-Δ^3-*cyclo*hexene-3-carboxylic acid. Synthesis of the *d*- and *l*-modification of Δ^3-*m*-menthenol(8) and $\Delta^{3:8(9)}$-*m*-menthadiene. By Bernard Dunstan Wilkinson Luff and William Henry Perkin, jun.	57	518
63. Experiments on the synthesis of the terpenes. Part XVII. *d*-Δ^3-*p*-menthenol(8) and *d*-$\Delta^{3:8(9)}$-*p*-menthadiene. By Tsan Quo Chou and William Henry Perkin, jun.	57	526
64. Some derivatives of *o*-veratraldehyde. (Preliminary note.) By William Henry Perkin, jun., Walter Morrell Roberts, and Robert Robinson	57	—
65. *iso*Oxyberberine. (Preliminary note.) By Norman Bland, William Henry Perkin, jun., and Robert Robinson	59	—
66. The application of viscometry to the measurement of rate of reaction. By Albert Ernest Dunstan and Albert George Mussell	59	565
67. The action of hydrogen sulphide on the alkyloxides of the metals. Part I. Sodium and potassium ethoxides. By Alexander Rule	60	558

	Page in Proceedings.	Page in Transactions.
68. Simple method of decomposing refractory tin ores. By Herbert Yabsley Loram	60	—
March 16th.		
69. Apparatus for the maintenance of constant pressures above and below the atmospheric pressure. Application to fractional distillation. By John Wade and Richard William Merriman	64	984
70. The influence of water on the boiling point of ethyl alcohol at pressures above and below the atmospheric pressure. By John Wade and Richard William Merriman	65	997
71. The interaction of aromatic disulphides and sulphuric acid. By William George Prescott and Samuel Smiles	65	640
72. The absorption spectra of permanganates in certain solvents. By Thomas Ralph Merton	66	637
73. The resolution of asymmetrical derivatives of phosphoric acid. By Frederic Stanley Kipping and Frederick Challenger	66	626
74. The action of carbon dioxide in the bleaching process. By Sidney Herbert Higgins	67	858
75. The relation between the absorption spectra of metallic ions and their valency. (Preliminary note.) By Cecil Reginald Crymble	68	—
76. The element Cu | Cu_2O alkali | H_2 at 0°. By Arthur John Allmand	69	840
77. A standard electrode with alkaline electrolyte: Hg | HgO alkali. By Frederick George Donnan and Arthur John Allmand	70	845
78. The volatile constituents of coal. Part II. By Maurice John Burgess and Richard Vernon Wheeler	70	649
79. The absorption spectra of chlorobenzene and bromobenzene as vapours, as liquids, and in solution. By John Edward Purvis	71	811
80. Orthophosphoric acid as a dehydrating catalytic agent. Part I. The condensation of acetone in presence of phosphoric acid. By Pañchānan Neogi	71	1249
81. Trialkylammonium nitrites and nitrites of the bases of the pyridine and quinoline series. Part I. By Pañchānan Neogi	71	1252
82. Nitrites of the alkylammonium bases: ethylammonium nitrite, dimethylammonium nitrite, and trimethylammonium nitrite. (Preliminary note.) By Prafulla Chandra Rây and Jitendra Nath Rakshit	71	—
83. Isomeric monothiophosphates. By William Gidley Emmett and Humphrey Owen Jones	72	713
84. The absorption spectra of chlorobenzene, the dichlorobenzenes, and the chlorotoluenes. By Edward Charles Cyril Baly	72	856

	Page in Proceedings.	Page in Transactions.
85. Chemical constitution and hypnotic action. Acid amides and products of the condensation of malonamides and malonic esters. By Frederic George Percy Remfry	72	610
86. *p*-Benzoyloxybenzaldehyde. By Frank George Pope	73	—
April 6th.		
87. The constituents of rhubarb. By Frank Tutin and Hubert William Bentley Clewer	89	946
88. 6-Nitro-3 : 4 : 3′ : 4′-tetramethyldiphenyl. By Arthur William Crossley and Charles Herbert Hampshire	90	721
89. Diphenylene, a new aromatic hydrocarbon. Part I. By James Johnston Dobbie, John Jacob Fox, and Arthur Josiah Hoffmeister Gauge	90	683
90. A new synthesis of 4(or 5)-β-aminoethylglyoxaline, one of the active principles of ergot. By Frank Lee Pyman	91	668
91. The synthesis of *r*-histidine. (Preliminary note.) By Frank Lee Pyman	92	—
92. A synthesis of phenanthrene. By James Kenner and Emily Gertrude Turner	92	—
93. The correlation of viscosity with other physical properties. Part I. The ethenoid and ethinoid unsaturation. By Thomas Percy Hilditch and Albert Ernest Dunstan	93	—
94. Chemical action induced by cathode rays and canal rays. By Edgar Philip Perman	94	833
95. Compounds of copper benzoate with pyridine and quinoline. By Oscar Lisle Brady	94	—
96. Experiments on the synthesis of the terpenes. Part XVIII. Synthesis of Δ^5-*o*-menthenol(8), Δ^6-*o*-menthenol(8), and the corresponding menthadienes. By William Henry Perkin, jun.	95	727
97 Experiments on the synthesis of the terpenes. Part XIX. Synthesis of *cis*- and *trans*-Δ^3-*o*-menthenol(8), Δ^4-*o*-menthenol(8), and the corresponding menthadienes. By William Henry Perkin, jun.	95	741
98. The condensation of ethyl crotonate and ethyl methylacrylate with ethyl cyanoacetate and ethyl bromoacetate. Synthesis of γ-methybutane-αββ-tricarboxylic acid and pentane-αββ-tricarboxylic acid. By Edward Hope and William Henry Perkin, jun.	95	762
99. The volume of a solute in solution. Part II. The influences of molecular association, solvate formation, and ionisation. By Dan Tyrer	96	871
100. An apparatus for precipitating, filtering, and drying in an inert gas. By James Brierley Firth and James Eckersley Myers	96	—
101. Triketohydrindene hydrate. Part III. Its relation to alloxan By Siegfried Ruhemann	97	792
102. Salts of 3 : 5-dinitroquinol. By William Bayliss Shaw	98	1609

	Page in Proceedings.	Page in Transactions.
103. The question of isomerism between naphthiminazoles. By Raphael Meldola	98	—
104. The determination of the density of liquids. By Harold Hartley and William Henry Barrett	100	1072
105. The influence of temperature on the basic water value of ethyl alcohol. By William Jacob Jones and Arthur Lapworth	100	917
106. Synthesis and resolution of gnoscopine (*dl*-narcotine). By William Henry Perkin, jun., and Robert Robinson	101	775
107. The occurrence of alizarin in rhubarb. By Hugo Müller	101	967
108. Coumaranone derivatives. Part I. By Richard William Merriman	101	911
109. The condensation of acetyl chloride and salicylamide. By Arthur Walsh Titherley and William Longton Hicks	102	866
110. The influence of salts on the autofermentation of yeast. (Preliminary note.) By Arthur Harden and Sydney Gross Paine	103	—
111. Preparation of secondary amines from carboxylic acids. Part II. Preparation of the heptadecyl and pentadecyl derivatives of α- and β-naphthylamine. By Henry Rondel Le Sueur	104	827
May 4th.		
112. The constituents of bryony root. By Frederick Belding Power and Charles Watson Moore	118	937
113. Reactivity of the halogens in organic compounds. Part VI. The mechanism of negative catalysis. By George Senter and Alfred William Porter	119	1049
114. The constitution of scopoletin. By Charles Watson Moore	119	1043
115. Note on the action of hydrogen dioxide on thiobenzanilide. By Harold Leete and Edward de Barry Barnett	120	—
116. Purification of acetic acid. By Kennedy Joseph Previté Orton, Muriel Gwendolen Edwards, and Harold King	120	1178
117. The detection and estimation of small quantities of acetic anhydride in acetic acid. By Muriel Gwendolen Edwards and Kennedy Joseph Previté Orton	121	1181
118. Tetramethylammonium hyponitrite and its decomposition by heat. By Prafulla Chandra Rây and Hemendra Kumar Sen	121	1466
119. The second and third dissociation constants of orthophosphoric acid. By Edmund Brydges Rudhall Prideaux	121	1224
120. Experiments on tautomerism. Part I. The tautomerism of the system X·CHR·CR:CR·X, showing the identity of the α- and γ-positions in the glutaconic acid molecule. By Ferdinand Bernard Thole and Jocelyn Field Thorpe	122	2187

	Page in Proceedings.	Page in Transactions.
121. Nitrites of the alkylammonium bases: ethylammonium nitrite, dimethylammonium nitrite, and trimethylammonium nitrite. By Prafulla Chandra Rây and Jitendra Nath Rakshit	122	1470
122. The relation of position isomerism to optical activity. Part IX. The rotation of the menthyl esters of the isomeric fluoro- and iodo-benzoic acids and of the halogen derivatives of the fatty acids. By Julius Berend Cohen	123	1058
123. The constitution of dehydro-β-naphthol sulphide and the interaction of sulphuric acid and aromatic *o*-hydroxysulphoxides. By Thomas Percy Hilditch and Samuel Smiles	123	973
124. The action of steam on iron at high temperatures. By John Albert Newton Friend, Thomas Ernest Hull, and Joseph Hallam Brown	124	969
125. Aromatic antimony compounds. Part II. The action of the chlorides of antimony on aniline and its derivatives. By Percy May	124	1382
126. Synthetical experiments in the group of *iso*quinoline alkaloids. Part I. Anhydrocotarninephthalide. By Edward Hope and Robert Robinson	125	1153
127. The solubility of electrolytes in aqueous solutions. Part I. Solubility of salts in the corresponding acids. By James Irvine Orme Masson	125	1132
128. The effect of temperature and of pressure on the equilibrium $2CO \rightleftharpoons CO_2 + C$. By Thomas Fred Eric Rhead and Richard Vernon Wheeler	126	1140
129. Nitrites of the benzylammonium series: benzylammonium nitrite and dibenzylammonium nitrite, and their sublimation and decomposition by heat. By Prafulla Chandra Rây and Rasik Lal Datta	127	1475
130. The conductivity and viscosity of aqueous solutions of aniline hydrochloride at 25°. By Nevil Vincent Sidgwick and Bernard Howell Wilsdon	127	1118
131. The solubility of aniline in aqueous solutions of its hydrochloride. By Nevil Vincent Sidgwick, Percival Pickford, and Bernard Howard Wilsdon	127	1122
132. Some reducing actions of mercury. By David Borar	128	1414
133. Note on the preparation of β-hydrindone. By Jocelyn Field Thorpe	128	—
May 18th.		
134. Some reactions of ω-bromomethylfurfuraldehyde. By William Francis Cooper and Walter Harold Nuttall	134	1193
135. A method for the accurate volumetric determination of the oxygen in air. By Herbert Edmeston Watson	135	1460
136. Mannitoboric acid. By John Jacob Fox and Arthur Josiah Hoffmeister Gauge	136	1075
137. Hydroaromatic ketones. Part II. 1:1:2-Trimethyl-*cyclo*hexan-3-one. By Arthur William Crossley and Nora Renouf	137	1101

	Page in Proceedings.	Page in Transactions.
138. The course of chemical change in quinol under the influence of radiant energy. By Walter Noel Hartley and Otway Henry Little	137	1079
139. Electrolytic reduction. Part IV. Aromatic aldehydes. By Herbert Drake Law	138	1113
140. Synthesis of ammonia by heat. By Ivor Southwell Cardell and Fred Thomas	138	—
141. A method of chlorination: chlorination of anilines and phenols. By Kennedy Joseph Previté Orton and Harold King	139	1185
142. The intermolecular condensation of aromatic sulphinic acids. Part II. The interaction of aromatic disulphoxides and sulphuric acid. By Thomas Percy Hilditch	139	1091
143. The action of sodium hyposulphite on copper sulphate in aqueous solution. By James Brierley Firth and James Eckersley Myers	139	1329
144. Note on some metallic compounds of substituted ammonias. By William Robert Lang	140	—
145. The decomposition of diethylenesulphidemethylsulphine hydroxide in aqueous solution. By Leila Green and Brenda Sutherland	140	1174
146. Properties of binary mixtures of some liquefied gases. By Lancelot Salisbury Bagster	141	1218
147. Note on the monosodium salt of 1-nitroso-2-naphthol-3:6-disulphonic acid. By Percy May	141	—
148. Synthesis of pinacones. Part I. By William Parry	141	1169
149. A method for the accurate estimation of traces of water in ether. By Dan Tyrer	142	—
150. Equilibrium in the system: ethyl alcohol, acetic acid, ethyl acetate and water, and its apparent displacement by hydrogen chloride. By William Jacob Jones and Arthur Lapworth	143	1427
151. The heat of hydrolysis of ethyl alcohol hydrochloride. A correction. By William Jacob Jones and Arthur Lapworth	143	—
152. Derivatives of silicoethane and silicoethylene. By Frederic Stanley Kipping	143	—
June 1st.		
153. The dissociation pressures of the alkali bicarbonates. Part I. Sodium hydrogen carbonate. By Robert Martin Caven and Henry Julius Salomon Sand	147	1359
154. The absorption spectra of cinchonine, quinine, and their isomerides. By James Johnston Dobbie and Alexander Lauder	148	1254
155. The constituents of the bulb of *Buphane disticha*. By Frank Tutin	149	1240
156. The interaction of formic acid and cellulose. By Charles Frederick Cross and Edward John Bevan	149	1450
157. Configuration of the stereoisomeric dibromosuccinic acids. (Preliminary note.) By Alex. McKenzie	150	—

	Page in Proceedings.	Page in Transactions.
158. The influence of conjugated linkings on general absorptive power. Part II. Some open-chain and cyclic compounds. By Cecil Reginald Crymble, Alfred Walter Stewart, Robert Wright, and Florence Williamson Rea	153	1262
159. New derivatives of aminolauronic acid. By John Weir	154	1270
160. The triazo-group. Part XVIII. β-Triazoethylamine. By Martin Onslow Forster and Sidney Herbert Newman	154	1277
161. The interaction of metallic oxides and phosphoryl chloride, alone and in the presence of certain organic compounds. By Henry Bassett, jun., and Hugh Stott Taylor	155	1402
162. A copper derivative of quinol. By Hugh Vernon Thompson	155	—
163. The action of salt solutions and of sea-water on iron at various temperatures. By John Albert Newton Friend and Joseph Hallam Brown	156	1302
164. Some derivatives of gelsemine. By Charles Watson Moore	157	1231
165. Syntheses with phenol derivatives containing a mobile nitro-group. Part IV. Quinone-imides, asymmetric quaternary ammonium compounds, and asymmetric carbinols. By Raphael Meldola and Harold Kuntzen	157	1283
166. Note on a colour change in β-paranitrophenol brought about by sunlight. By Thomas Vipond Barker	158	—
167. The sensitiveness of pentamminenitrosocobalt salts to light. By Oskar Krafft Heinrich Burger	160	—
168. Lecture experiment to illustrate dust explosions. The surface areas of certain finely-divided combustible solids. By William Robert Lang and Hoyes Lloyd	161	—
169. The constitution of berberine. By Charles Kenneth Tinkler	162	1340
170. Triketohydrindene hydrate. Part IV. Hydrindantin and its analogues. By Siegfried Ruhemann	163	1306
171. Aminoquercetin. (Preliminary note.) By Edwin Roy Watson	163	—
172. The reduction of nitroacenaphthene. By Holland Crompton and Maggie Walker	165	—
173. Epicamphor: a new isomeride of camphor. (Preliminary note.) By Frederick Russell Lankshear and William Henry Perkin, jun.	166	—
June 15th,		
174. The alleged complexity of tellurium. By Augustus George Vernon Harcourt and Herbert Brereton Baker	187	1311
175. The purification and properties of acetic acid. By William Robert Bousfield and Thomas Martin Lowry	187	1432
176. The solubility of carbon dioxide in beer. By Alexander Finlay and Bucchok Shen	189	1313

	Page in Proceedings.	Page in Transactions.
177. An addition to the Buchner funnel. By Alfred Charles Glyn Egerton	189	—
178. The action of ammonia and amines on 2-phenyl-1 : 3-benzoxazine-4-one. By Arthur Walsh Titherley and Ernest Chislett Hughes	190	1493
179. Synthesis of 4 : 6-dimethoxy-2-β-methylaminoethylbenzaldehyde. By Arthur Henry Salway	191	1320
180. Cupriglycollates. By Spencer Umfreville Pickering	192	1347
181. Polymorphic phthalylhydrazides. By Frederick Daniel Chattaway and Donald Frederick Sandys Wünsch	193	2253
182. Decomposition of hydrazides and hydrazones by heat. By Frederick Daniel Chattaway, Charles Linaeus Cumming, and Bernard Howell Wilsdon	193	1950
183. Some reactions of gum kino. By John Lionel Simonsen	194	1530
184. Electromotive forces in alcohol. Part I. Concentration cells with electrodes reversible to chlorine ions. By Arthur Lapworth and James Riddick Partington	194	1417
185. Some oxidation products of the hydroxybenzoic acids. Part III. By Arthur George Perkin	194	1442
186. The triazo-group. Part XIX. Nitrosoazides of dipentene, *d*-limonene, and *l*-limonene. By Martin Onslow Forster and Frederik Marinus van Gelderen	195	2059
187. The relation of the velocity of chlorination of aromatic compounds to constitution. Part I. Chlorination of anilides. By Kennedy Joseph Previté Orton and Harold King	196	1369
188. Chlorination of acylanilides. Effect of the constitution of the acyl group on the proportion of the ortho- and para-derivatives. By Harold King and Kennedy Joseph Previté Orton	196	1377
189. The influence of the alternating factor in certain series on the molecular volumes at the melting point. By Gervaise Le Bas	196	—
190. The elimination of bromine from phenyl *p*-methoxystyryl ketone dibromide. By Forsyth James Wilson and Alfred Archibald Boon	197	—
191. Some new inorganic salts. By Thomas Vipond Barker	198	1326
Papers received during the vacation and published, or passed for publication, in the Transactions:		
192. Indicators of the methyl-red type. By Hubert Howard and Frank Geo. Pope	206	1333
193. Dihydrocinnamenylcarbimide (β-phenylethyl *iso*-cyanate). By Martin Onslow Forster and Hermann Stötter	206	1337
194. The synthesis of histidine. By Frank Lee Pyman	206	1386
195. The action of benzylamine on *s*-dibromosuccinic acid. By Edward Percy Frankland	206	1775

	Page in Proceedings.	Page in Transactions.
196. A method of determining carbon and nitrogen in organic compounds. By Edward Percy Frankland	207	1783
197. The synthesis of derivatives of thioxanthone from aromatic disulphides. By Effie Gwendoline Marsden and Samuel Smiles	207	1353
198. Trialkylammonium nitrites and nitrites of the bases of the pyridine and quinoline series, Part II. By Pañchânan Neogi	208	1593
199. The density of liquid sucrose and of its solutions in water. By Frederik Schwers	208	1478
200. The condensation of crotonaldehyde. By Ida Smedley	208	1627
201. Ionisation in non-aqueous solvents. Part I. By Harry Medforth Dawson and May Sybil Leslie	208	1601
202. The formation of glyoxalines from acyl derivatives of α-keto-β-anilino-αβ-diphenylethane. By Arthur Ernest Everest and Hamilton McCombie	209	1746
203. The osmotic pressure and conductivity of aqueous solutions of Congo-red, and on reversible membrane-equilibria. By Frederick George Donnan and Albert Buckley Harris	209	1554
204. Triketohydrindene hydrate. Part V. The analogues of uramil and purpuric acid. By Siegfried Ruhemann	210	1486
205. The constitution of the organic ferrocyanides. By Ernald George Justinian Hartley	211	1549
206. Contributions to the chemistry of the terpenes. Part IX. The oxidation of camphene with hydrogen peroxide. By George Gerald Henderson and Maggie Millen Jeffs Sutherland	211	1539
207. Synthesis of derivatives of thioxanthone. Part III. 1 : 4-Dihydroxythioxanthone. By Hans Thacher Clarke and Samuel Smiles	212	1535
208. Optically active derivatives of 1-methyl*cyclo*hexylidene-4-acetic acid. By William Henry Perkin, jun., and William Jackson Pope	212	1510
209. Substitution in aromatic hydroxy-compounds. Part I. The action of nitric acid on gallic acid trimethyl ether and pyrogallolcarboxylic acid trimethyl ether. By Victor John Harding	213	1585
210. The solubility of cuprous oxide in aqueous ammonia solutions, and the composition of the cuprous-ammonia complex. By Frederick George Donnan and John Smeath Thomas	213	1788
211. The acid character of gallotannic acid. By Ramni Paniker and Edmund Stiasny	213	1819
212. Synthesis of polypeptides of α-amino-*n*-nonoic acid with glycine, alanine, valine, leucine, asparagine, and aspartic acid. By Arthur Hopwood and Charles Weizmann	214	1577
213. Latent heats of vaporisation of mixed liquids. Part I. By Dan Tyrer	215	1633
214. *iso*Quinoline derivatives. Part VI. *neo*Oxyberberine. By Frank Lee Pyman	215	1690

	Page in Proceedings.	Page in Transactions.
215. The system: palmitic acid–sodium palmitate. By Frederick George Donnan and Albert Simpson White	216	1668
216. The β-chlorocinnamic acids. By Thomas Campbell James	216	1620
217. Substances related to cochenillic and carminic acids. Part I. Synthesis of the methyl ether of β- and of γ-coccinic acids. By Andrew Norman Meldrum.	216	1712
218. The synthesis of hydrocarbons at high temperatures. By John Norman Pring and Dorian Macefield Fairlie	217	1796
219. 2 : 2′-Dibromodiphenyl and 2 : 2′-dichlorodiphenyl. By James Johnston Dobbie, John Jacob Fox, and Arthur Josiah Hoffmeister Gauge	217	1615
220. The absorption spectra of various chlorine and bromine derivatives of benzene and of toluene as vapours, in solution, and in thin films. By John Edward Purvis	218	1699
221. The effect of heat on a mixture of benzaldehydecyanohydrin and aniline. By Arthur Ernest Everest and Hamilton McCombie	218	1752
222. The formation and reactions of imino-compounds. Part XVI. Reactions leading to the formation of tricarballylic acid. By Ferdinand Bernard Thole and Jocelyn Field Thorpe	219	1684
223. Composition of the essential oil of *Myrica Gale*, L. By Samuel Shrowder Pickles	220	1764
224. Trimercuridiethylammonium nitrite. By Prafulla Chandra Rây and Jitendra Nath Rakshit	220	1972
225. The chlorine derivatives of pyridine. Part XI. Some interactions of 3 : 4 : 5-trichloropicolinic acid and of its derivatives. By William James Sell	220	1679
226. An application of Kirchhoff's equation to solutions. (A contribution to the thermodynamic theory of solubility.) By Robert Taylor Hardman and James Riddick Partington	221	1769
227. The aerial oxidation (rusting) of metals. By Wyndham Rowland Dunstan and John Robertshaw Hill	221	1835
228. The passivity of iron and certain other metals. By Wyndham Rowland Dunstan and John Robertshaw Hill	222	1853
229. The reactivity of ketones towards iodine and the relative rates of tautomeric change. Part II. By Harry Medforth Dawson and Harry Ark	223	1740
230. The photochemical and thermal interaction of chlorine and carbon monoxide. By David Leonard Chapman and Frank Houghton Gee	223	1726
231. Decomposition of dry ozone. By David Leonard Chapman and Herbert Edwin Jones	224	1811
232. The absorption spectra of the isomeric hydrazones and semicarbazones of camphorquinone. By Frederick Russell Lankshear and Arthur Lapworth	224	1785
233. Bimolecular glycollaldehyde. By Nial Patrick McCleland	224	1827
34. Myricetin. Part III. By Arthur George Perkin	225	1721

	Page in Proceedings.	Page in Transactions.
235. The influence of inactive electrolytes on the optical activity of *l*-malic acid in aqueous solution. By Clifford Morgan Stubbs	225	2265
236. New derivatives of diphenoquinone and a new variety of stereoisomerism. By James Moir	226	—
October 19th.		
237. The alkaline condensations of nitrohydrazo-compounds. By Arthur George Green and Ernest Arthur Bearder.	228	1960
238. The characteristics and chemical composition of some early matches. By Edwy Godwin Clayton	229	2297
239. Experiments on the Walden inversion. Part VII. Action of phosphorus pentachloride and of thionyl chloride on optically active hydroxy-acids and esters. By Alex. McKenzie and Fred Barrow	232	1910
240. Note on the preparation of the *syn*-aldoximes. By Albert Ernest Dunstan and Ferdinard Bernard Thole	233	—
241. The absorption spectra of the nitration products of dimethyl-*p*-toluidine. By Gilbert T. Morgan and Arthur Clayton	233	1941
242. The action of *Allium sativum* (garlic) juice on lead and mercury. By Manindra Nath Banerjee	234	—
243. Note on *p*-methoxysalicylaldehyde and its occurrence in the root of a species of Chlorocodon. By Ernest Goulding and Russell George Pelly	235	—
244. A simple apparatus for sublimation in a vacuum. By Harold Christopher	236	—
245. Note on the dehydration of crystals. By James Brierley Firth	237	—
246. The diphenylcarbamyloximes. (Preliminary note.) By Frederick Percy Dunn	239	—
247. Some reactions of phenyl *iso*propyl ketone. By Arthur Lapworth and Victor Steele	239	1882
248. A new stereoisomeride of cyanodihydrocarvone. By Arthur Lapworth and Victor Steele	240	1877
249. The action of hydrogen cyanide on carvone hydrosulphide. By Victor Steele	240	—
250. Preparation of the nitrites of the primary, secondary, and tertiary ammonium bases. (Preliminary note.) By Pañchānan Neogi	242	—
251. Studies of ammonium solutions. Part I. An ammonium electrode. By Roland Edgar Slade	242	1974
252. The absorption spectra of triketohydrindene hydrate and certain derivatives. By John Edward Purvis	242	1953
253. The action of chlorine on alkalis and of carbon dioxide on bleaching powder. By Robert Llewellyn Taylor	243	1906
254. The relation between residual affinity and chemical constitution. Part II. Certain compounds of nitrogen. By Hans Thacher Clarke	243	1927
255. Theory of dyeing: colour and molecular state of picric acid. By William Porter Dreaper	244	2094

	Page in Proceedings.	Page in Transactions.
256. Electromotive forces in alcohol. Part II. The hydrogen electrode in alcohol and the influence of water on its electromotive force. By Robert Taylor Hardman and Arthur Lapworth	244	2242
257. Notes on new coumarin derivatives. By Arthur Clayton	245	—
258. The temperature coefficient of the electrical conductivity of hydrogen chloride in alcoholic solution. By James Riddick Partington	247	1937
259. The constituents of the oil of *Pinus longifolia*. By Henry Haliburton Robinson	247	—
260. The active constituents of the Indian solanaceous plants: *Datura Stramonium D. fastuosa*, and *D. Metel*. By Albert Edward Andrews	248	1871
261. Contributions to the chemistry of the terpenes. Part X. The action of chromyl chloride, nitrous acid, and nitric acid on bornylene. By George Gerald Henderson and Isidor Morris Heilbron	248	1887
262. The constitution of camphene. By George Gerald Henderson and Isidor Morris Heilbron	249	1901
263. Candelilla wax. By James McConnell Sanders	250	—
264. A convenient method for determining the density of heavy petroleums. By James McConnell Sanders	250	—
265. The probable cause of the elimination of a carbethoxyl group as ethyl carbonate by the action of sodium ethoxide. By Ferdinand Bernard Thole and Jocelyn Field Thorpe	252	2183
266. The chemistry of the glutaconic acids. Part II. The reactions of the alkylglutaconic acids having one mobile hydrogen atom. By Ferdinand Bernand Thole and Jocelyn Field Thorpe	252	2208
November 2nd.		
267. The constituents of the seeds of *Casimiroa edulis*. By Frederick Belding Power and Thomas Callan	257	1993
268. Preparation of the betaine of tryptophan and its identity with the alkaloid hypaphorine. By Pieter van Romburgh and George Barger	258	2068
269. β-2-Methoxynaphthylpropionic acid and methoxy*peri*-naphth-hydrindone. By George Barger and Walter William Starling	258	2030
270. Some derivatives of 4(or 5)-methylglyoxaline. By Arthur James Ewins	259	2052
271. Studies in the camphane series. Part XXX. Constitution of pernitrosocamphor (camphenylnitroamine). By Martin Onslow Forster, John Robert Trotter, and Jacob Weintroube	259	1982
272. Dihydroxydihydrindamine and its resolution into optically active components. By William Jackson Pope and John Reed	259	2071
273. Studies in phototropy and thermotropy. Part II. Naphthylideneamines. By Alfred Senier and Rosalind Clarke	260	2081

	Page in Proceedings.	Page in Transactions
274. The stability of the double oxalates of sodium and nickel, and sodium and cobalt. By John Wallis Dodgson	260	—
275. The lower limit of inflammation of mixtures of the paraffin hydrocarbons with air. By Maurice John Burgess and Richard Vernon Wheeler	262	2013
276. Formation of six- and seven-membered rings from derivatives of 2 : 2′-ditolyl. By James Kenner and Emily Gertrude Turner	262	2101
277. Syntheses with phenol derivatives containing a mobile nitro-group. Part V. Quinoneimides, asymmetric quaternary ammonium compounds, and asymmetric carbinols (continued). By Raphael Meldola and Harold Kuntzen	263	2034
278. Isomeric acetaldehydephenylhydrazones. By Ernyst Graham Laws and Nevil Vincent Sidgwick	263	2085
279. Nitrites of the alkylammonium series. Part IV. Triethylammonium nitrite and its decomposition and sublimation by heat. By Prafulla Chandra Rây and Jitendra Nath Rakshit	264	—
280. The formation of dichlorocarbamide and its behaviour towards amines. By Rasik Lal Datta	264	—
281. Synthetical experiments in the group of the *iso*-quinoline alkaloids. Part II. The constitution of the condensation products of cotarnine and the condensation of cotarnine with aliphatic and aromatic nitro-compounds. By Edward Hope and Robert Robinson	265	2114
282. The synthesis of derivatives of thioxanthone. Part IV. Synthesis from aromatic sulphinic acids. By Harold Christopher and Samuel Smiles	265	2046
283. Komppa's synthesis of camphoric acid. By Gustave Louis Blanc and Jocelyn Field Thorpe	265	2010
284. The electrochemistry of solutions in acetone. Part I. By Alexander Roshdestwensky and William Cudmore McCullagh Lewis	266	2138
285. Chlorination of α-naphthol by acetylchloroamino-2 : 4-dichlorobenzene. By Harold King	266	—
November 16th.		
286. Chemical examination of Calabar beans. By Arthur Henry Salway	273	2148
287. Organic derivatives of antimony. Part II. The orienting influence of antimonic substituents in the benzene nucleus. By Gilbert T. Morgan and Frances M. G. Micklethwait	274	2286
288. Aminoalkylglyoxalines. By Frank Lee Pyman	275	2172
289. The influence of neutral solvents on velocity of reaction. Part I. Transformation of anis*syn*-aldoxime in various solvents. By Thomas Stewart Patterson and Harvey Hugh Montgomerie	276	26*

	Page in Proceedings.	Page in Transactions.
290. Copper salts and their behaviour with alkalis. By Spencer Umfreville Pickering	276	—
291. Contributions to the chemistry of the terpenes. Part XII. Synthesis of a menthadiene from thymol, and of a diethyl*cyclo*hexadiene from phenol. By George Gerald Henderson and Robert Boyd	276	2159
292. The synthesis of damasceninic acid (2-methylamino-3-methoxybenzoic acid). (Preliminary note.) By Arthur James Ewins	277	—
293. The oxidation of camphene with hydrogen peroxide. (A correction.) By George Gerald Henderson and Maggie Millen Jeffs Sutherland	277	—
294. Note on the preparation of labile benzaldehyde-phenylhydrazone. By Ferdinand Bernard Thole	278	—
295. The separation of mixtures of organic acids by partial esterification. By John Joseph Sudborough and Ebenezer Rees Thomas	279	2307
296. Preparation of the ketones of the higher fatty acids. By Thomas Hill Easterfield and Clara Millicent Taylor	279	2298
297. Complex thio-oxalates. By Charles Stanley Robinson and Humphrey Owen Jones	279	62*
298. The absorption spectra of various iodine derivatives of benzene and toluene as vapours, in solution and in thin films. By John Edward Purvis	280	2318
299. The transformation of ammonium cyanate into carbamide. By Frederick Daniel Chattaway	280	—
300. The condensation of ethyl citraconate with ethyl sodiomalonate. Formation of *cyclo*pentanone-4-carboxylic acid. (Preliminary note.) By Edward Hope	281	—
301. The relative activities of certain organic iodo-compounds. (Preliminary note.) By David Segaller	283	—
302. Some α'-derivatives of camphor. By James Ernest Marsh	283	—
303. The velocity of addition of alkyl bromides to cyclic tertiary bases. By Frank Stevenson Long	283	2164
304. The essential oil of *Origanum hirtum*, Link. (Preliminary note.) By Samuel Shrowder Pickles	284	—
305. The essential oil of Dalmatian white thyme. (Preliminary note.) By Samuel Shrowder Pickles	285	—
306. The molecular configuration of 1-methyl*cyclo*hexylidene-4-acetic acid and of the oxime of *cyclo*hexanone-4-carboxylic acid. By Arthur Ernest Everest	285	—
307. Nitrites of the alkylammonium series. Part II. Propylammonium nitrite and butylammonium nitrite and their decomposition by heat By Prafulla Chandra Rây and Jitendra Nath Rakshit	291	141*
December 7th,		
308. Chemical examination of the root of *Ipomœa orizabensis*. By Frederick Belding Power and Harold Rogerson	304	1*

	Page in Proceedings.	Page in Transactions.
309. The constitution of ergothioneine: a betaine related to histidine. By George Barger and Arthur James Ewins	305	2336
310. The methane equilibrium. By John Norman Pring and Dorian Macefield Fairlie	305	91*
311. The decomposition of nitric acid by light. By Willian Colebrook Reynolds and William Henry Taylor	306	131*
312. Derivatives of *o*-xylene. Part I. 3-Nitro-*o*-xylene and 3 : 6-dinitro-*o*-xylene. By Arthur William Crossley and Gertrude Holland Wren	307	2341
313. Derivatives of *o*-xylene. Part II. Dinitro-*o*-xylidines. By Arthur William Crossley and George Francis Morrell	307	2345
314. The absorption of the halogens by dry slaked lime. By William Arthur Reginald Wilks	308	—
315. A method of determining carbon and nitrogen in organic compounds. By Edward Percy Frankland	309	—
316. Diphenyl*cyclo*pentenone. By Siegfried Ruhemann and William Johnson Smith Naunton	309	42*
317. Electrolytic reduction. Part V. Benzylidene bases. By Herbert Drake Law	310	—
318. The porosity of iron and its relation to passivity and corrosion. By John Albert Newton Friend	311	50*
319. Molecular rotatory power in normal homologous series. Part I. Optically active derivatives of the higher aliphatic alcohols and acids. By Thomas Percy Hilditch	311	—
320. Molecular rotatory power in normal homologous series. Part II. The menthyl esters of the α-bromoaliphatic acids. By Harold Christopher and Thomas Percy Hilditch	312	—
321. Note on methyl-*n*-tridecyl- and methyl-*n*-pentadecyl-carbinols and the corresponding ketones. By Robert Howson Pickard and Joseph Kenyon	312	—
322. An experimental investigation of the bleaching process. By Sydney Herbert Higgins	314	—
323. The direct esterification of saturated and unsaturated acids. By Ebenezer Rees Thomas and John Joseph Sudborough	314	—
324. The influence of three- and four-membered carbon rings on the refractive and dispersive power of organic compounds. By Gustaf Jim Östling	315	—
325. Contributions to our knowledge of semicarbazones. (Preliminary note.) By Isidor Morris Heilbron and Forsyth James Wilson	315	—
326. Conductivity and dissociation of diacetyltartaric acid. By Stella Deakin and Albert Cherbury David Rivett	316	127*
327. A synthesis of "thioindigo." (Preliminary note.) By William George Prescott and Samuel Smiles	317	—
328. Asymmetry in the supposed absence of an asymmetric atom. By James Ernest Marsh	317	—
329. Latent heats of vaporisation of mixed liquids. Part II. By Dan Tyrer	319	81

	Page in Proceedings.	Page in Transactions.
330. Influence of double linking on optical activity. By Percy Faraday Frankland and Hugh Henry O'Sullivan	319	2325
331. The action of aliphatic amines on *s*-dibromosuccinic acid. Part I. By Edward Percy Frankland and Henry Edgar Smith	320	57*
332. The velocity of interaction of iodic and sulphurous acids in various media. By Thomas Stewart Patterson and William Collins Forsyth	320	40*
December 21st.		
333. Investigations on the dependence of rotatory power on chemical constitution. Part II. The rotations of some secondary alcohols containing the *iso*propyl group. By Robert Howson Pickard and Joseph Kenyon	324	—
334. The alcohols of the hydroaromatic and terpene series. Part II. The menthols corresponding with optically inactive menthone. By Robert Howson Pickard and William Oswald Littlebury	324	109*
335. The absorption spectra of quinine, cupreine, 6-methoxyquinoline, and 6 hydroxyquinoline. By James Johnston Dobbie and John Jacob Fox	325	77*
336. Amino-derivatives of arylsulphonanilides and arylsulphon-β-naphthalides. By Gilbert T. Morgan and Frances M. G. Micklethwait	326	143*
337. The action of nascent hydrogen on nitric acid. By Manindra Nath Banerjee and Satish Chandra Banerjee	326	—
338. Studies in the camphane series Part XXXI. Condensation of camphorquinone with nitromethane, ethyl cyanoacetate, and phenylacetonitrile. By Martin Onslow Forster and John Charles Withers	327	—
339. Solutions of halogen double salts in water and ether. By James Ernest Marsh	328	—
340. The relation between the absorption spectra of metallic ions and their valency. By Cecil Reginald Crymble	328	—
341. The solubility of electrolytes in aqueous solutions. Part II. Solubility of oxalic acid in other acids. By James Irvine Orme Masson	328	103*
342. The determination of sulphur in petroleum. By James McConnell Sanders	329	—
EXTRA MEETINGS.		
March 23rd.—Annual General Meeting	77	577
November 23rd.—Berthelot Memorial Lecture	—	2353

* Papers printed in the Transactions for 1912 are distinguished by an asterisk after the Page number. Where no reference is given to the Transactions, the paper has so far appeared only in the Proceedings.

LIBRARY RULES.

1. The Library is open for reference, and for the issue and return of books, daily from 10 a.m. to 6 p.m. (Saturdays 10 a.m. to 2 p.m.); and in the evenings of those days on which the Chemical Society meets.

2. Fellows are not allowed to have on loan more than *six* volumes at a time, without special permission from the Librarian.

3. All Journals, Dictionaries, and Pamphlets of which there are not duplicate copies, and certain early Chemical and other Books distinguished in the Library Catalogue by a star, belong to the Reference Library, and are not for general circulation. Fellows desiring to borrow books from the Reference Library must make a special application in writing to the Librarian, undertaking to bear all risks of transit, &c., and to return the volumes within one month; the Librarian may then, at his discretion, issue such books. This regulation does not apply, however, to volumes of Periodicals of which no duplicate copies exist in the Library.

4. A book may not be taken out of the Library until one month after it has been received.

5. Books must not be removed from the Library until a voucher for them has been signed and delivered to the Librarian.

6. Books are issued either to the Fellow desiring the loan, or to a person bringing a written order from him. In either case a receipt must be given on the form provided. When a Fellow desires a book or books to be sent to him, he must send to the Librarian a written order, and pay the whole cost of carriage. All books borrowed by Fellows shall be at the risk of the borrower from the moment they are issued or despatched by the Librarian, and until they are returned to him.

7. Books may not be sent out of the United Kingdom.

8. Books which have been bespoken shall circulate in the order of application.

9. Fellows shall be at liberty to retain a book one calendar month, unless, at the expiration of a fortnight, notice is received that the book is required by another Fellow, in which case it must be returned at once. Single parts of journals may not be retained longer than one week.

10. The names of Fellows borrowing books shall be entered by the Librarian, or Officer in attendance, in a book kept for that purpose. When a Fellow returns a book, his voucher shall be given to him, and a record of the return duly made.

11. In the case of Fellows returning books by messenger or public conveyance, the voucher shall be returned by the Librarian through the post.

12. Fellows retaining books longer than the time specified, or neglecting to return them when demanded, shall forfeit the right to borrow books from the Library until the volume or volumes be returned.

13. Fellows to whom books have been issued shall be held responsible for their preservation from injury; and if any book when returned is found to have been damaged, the Council may order that it be repaired or replaced at the expense of the borrower. In the event of any book being lost, or being detained after application has been made for its return, the Council may replace, at the cost of the borrower, the volume or volumes so lost or detained. This rule shall also apply to single parts of current periodicals.

14. For the purpose of revision and cleaning, the Library shall be closed for a fortnight in August of each year; before which time all books must be returned, unless special permission has been previously obtained from the Librarian. In the event of any book not being returned on such occasion, the Council may replace it at the cost of the borrower.

15. No persons other than Fellows of the Society have the privilege of using the Library, except upon a written introduction from a Fellow, with whom rests the responsibility for all books consulted by the person introduced. Such introduction shall be valid for one occasion only.

ADDITIONS TO THE LIBRARY DURING THE YEAR 1911.

Abegg, *Richard.* Chemische Affinität, Valenz und das natürliche System der Elemente. (From "Scientia," 1910, 8.)

Accum, *Fredrick.* Description of the process of manufacturing coal gas, . . . with elevations, sections and plans. pp. xvi + 334. ill. London 1819. (*Reference.*)

Allen, *Alfred Henry.* Commercial organic analysis. Vols. IV. and V. 4th edition. Edited by *W. A.* **Davis** and *Samuel S.* **Sadtler.** pp. viii + 466, ix + 704. ill. London 1911.

Anschütz, *Richard.* See **Richter,** *Victor von.*

Artephius. See **Salmon,** *William.*

Autenrieth, *Wilhelm,* and **Tesdorpf,** *Theodor.* Über eine kolorimetrische Bestimmung des Traubenzuckers im Harn. (From the *Münch. med. Woch.,* 1910, **37.**)

Avogadro, *Amedeo.* Opere scelte. Pubblicate dalla R. Accademia delle Scienze di Torino. pp. cxl + 491. Portrait. Torino 1911. (*Reference.*)

Backer, *Hilmar Johannes.* De Nitraminen en hunne electrochemische reductie tot Hydrazinen. pp. xv + 242. Leiden 1911.

Bacon, *Roger.* See **Salmon,** *William.*

Bacon, *William N.* See **Cross,** *Charles Frederick.*

Bang, *Ivar.* Chemie und Biochemie der Lipoide. pp. xi + 187. Wiesbaden 1911.

Barlow, [*Peter*]. Barlow's Tables of squares, cubes, square roots, cube roots, reciprocals of all integer numbers up to 10,000. Stereotype edition, examined and corrected. pp. viii + 200. London 1840.

Barthel, *Chr.* Methods used in the examination of milk and dairy products. Translated by *W.* **Goodwin.** pp. xi + 260. ill. London 1910.

Beck, *Karl,* and **Stegmüller,** *Ph.* Über die Löslichkeit von Bleisulfat und Bleichromat für sich, in Gemischen und in Form von Ölfarben in verdünnter Salzsäure, sowie über das Gleichgewicht von Chromat und Bichromat in Lösung. (From the *Arb. K. Gesundh.-Amt,* 1910, **34.**)

Bemmelen, *Jakob Maarten van.* Gedenkboek aangeboden aan J. M. van Bemmelen, 1830–1910. pp. xxix + 461. Helder 1910.

Berzelius, *Jöns Jacob.* Essai sur la théorie des proportions chimiques et sur l'influence chimique de l'électricité. Traduit du Suédois. pp. xvi + 190 + [ii] + 120 + [ii]. Paris 1819.

Bevan, *Edward John.* See **Cross,** *Charles Frederick.*

Beveridge, *Wilfred William Ogilvy.* A report on the determination of the amount of tin in tinplate used for canning preserved food. (From the *J. Roy. Army Med. Corps*, 1911.)

Biéchy, *Theodor.* See **Heiduschka,** *Alfred.*

Bingham, *Eugene C.*, and **White,** *George F.* Laboratory manual of inorganic chemistry. pp. viii + 146. New York 1911.

Birch, *Thomas.* The life of the Honourable Robert Boyle. pp. [iv] + 458 + [xvi]. London 1744.

Blount, *Bertram*, and **Bloxam,** *Arthur George.* Chemistry for engineers and manufacturers. 2nd edition. 2 vols. pp. xii + 392, xv + 513. ill. London 1911, 1910.

Bloxam, *Arthur George.* See **Blount,** *Bertram.*

Blücher, *H.* Modern industrial chemistry. Translated by *J. P.* **Millington.** pp. xvi + 779. ill. London 1911. (*Reference.*)

Bock, *Johannes.* Über die Ausscheidung der Alkalimetalle bei der Purindiurese. (From the *Skand. Arch. Physiol.*, 1911, **25.**)

Böttger, *Wilhelm.* Stand und Wege der analytischen Chemie. (Die chemische Analyse, Vol. XIII.) Stuttgart 1911.

Bokorny, *Th.* See **Loew,** *Oscar.*

Bothamley, *Charles Herbert.* The Ilford manual of photography. pp. vi + 218. ill. Ilford. n.d.

Boyle, *Robert.* Philosophical works, Abridged . . . by *Peter* **Shaw.** 2nd edition, corrected. 3 vols. pp. [iv] + xliii + 730, xx + 726, [iv] + xv + iv + 756. ill. London 1738.

—— See **Birch,** *Thomas.*

Braccesco, *Giovanni.* La espositione di Geber Filosofo . . . , nella quale si dichiarano molti nobilissimi secreti della Natura. In Vinegia appresso Gabriel Giolito dé Ferrari 1562. pp. 160. (*Reference.*)

Brauns, *Dirk Hendrik.* Theory of the rotation of the plane of polarisation. pp. 21. Detroit 1911.

Cain, *John Cannell.* See **Roscoe,** *The Right Honourable Sir Henry Enfield.*

Calliess, *Franz Wilhelm.* Über Ephedrin und Pseudoephedrin. (From the *Apoth. Zeit.*, 1910, **25.**)

Carnot, *Adolphe.* Traité d'analyse des substances minérales. Vol. III. pp. 903. Paris 1910.

Carré, *P.* Hydrocarbures, alcools et éthers de la série grasse. pp. 410. Paris 1911.

Castell-Evans, *John.* Physico-chemical tables. Vol. II. Physical and analytical chemistry. pp. xiv + 549 to 1235. London 1911.

Chalon, *Paul F.* Les explosifs modernes. 3rd edition. pp. vi + 789. Paris 1911.

Civetta, *Angelo.* See **Prandi**, *Oreste.*

Clacher, *William.* Some notes on animal charcoal. (From the *Int. Sugar J.*, 1910.)

—— The manufacture of carbons. (From the *Electrical Review*, 1911, **68.**)

Clowes, *Frank*, and **Coleman**, *Joseph Bernard.* Quantitative chemical analysis. 9th edition. pp. xxiv + 565. ill. London 1911.

Coleman, *Joseph Bernard.* See **Clowes**, *Frank.*

Comanducci, *Ezio.* Die Konstitution der Chinaalkaloide. (Sammlung, Vol. XVI.) Stuttgart 1911.

—— Tallochinina. pp. 7. Napoli 1910.

Contino, A. Sulla quantità di manganese in alcuni terreni Italiani. (From the *Staz. sper. agrar. ital.*, 1911, **44.**)

Coventry, *Bernard.* Report on the progress of agriculture in India for 1909–10. pp. 106. Calcutta 1911.

Cross, *Charles Frederick*, **Bevan**, *Edward John*, **Sindall**, *Robert Walter*, and **Bacon**, *William N.* Wood pulp and its uses. pp. xi + 270. ill. London 1911.

Davies, *Samuel Henry.* See **Jörgensen**, *Alfred.*

Davis, *William Alfred.* See **Allen**, *Alfred Henry.*

Davy, *Sir Humphry.* See **Paris**, *John Ayrton.*

Decker, *Herman.* See **Graebe**, *Carl.*

Desch, *Cecil Henry.* Chemistry and testing of cement. pp. xi + 287. ill. London 1911.

Dibdin, *William Joseph.* Notes of lecture on mortar and cement. pp. 32. London 1911.

Dictionary (An explanatory) of the apparatus and instruments employed in the various operations of philosophical and experimental chemistry. With seventeen quarto copper-plates. By a Practical Chemist. pp. vii + 296. London 1824.

Dunstan, *Albert Ernest*, and **Thole**, *Ferdinand Bernard.* Textbook of practical chemistry for technical institutes. pp. viii + 335. ill. London 1911.

Dyer, *Bernard*, and **Shrivell**, *F. W. E.* The manuring of market garden crops. pp. 144. ill. London 1910.

Edge, *John Harold.* Notes on practical cotton finishing. pp. 103. ll. London 1911.

Espagnet, *Joannes d'.* Das Geheime Werck der Hermetischen Philosophie, Worinnen die natürlichen und künstlichen Geheimnüsse der Materie des Philosophischen Steins, wie auch die Art und Weise zu arbeiten richtig und ordendlich offenbahret sind. pp. [xii] + 90. [Wanting pp. 37–38, 71–72 and 87–88.] Leipzig 1685. (*Reference.*)

Fagan, *Thomas Wallace.* See **Lauder,** *Alexander.*

Fischel, *Richard.* Der histochemische Nachweis der Peroxydase. (From the *Wien. klin. Woch.*, 1910, **23.**)

Fischer, *Ferdinand.* Kraftgas, seine Herstellung und Beurteilung. pp. viii + 236. ill. Leipzig 1911.

Flamel, *Nicolas.* See **Salmon,** *William.*

Forssner, *Gunnar.* Über die Einwirkung des Nahrungsfettes auf die Acetonkörperausscheidung. (From the *Skand. Archiv. Physiol.*, 1910, **23.**)

Fouard, *Eugène.* L'état colloïdal de l'amidon et sa constitution physicochimique. pp. 147. Laval 1911.

Fowler, *Gilbert John.* An introduction to bacteriological and enzyme chemistry. pp. viii + 328. ill. London 1911.

Friedheim, *Carl.* See **Gmelin,** *Leopold.*

Friend, *John Albert Newton.* Elementary domestic chemistry. pp. x + 180. ill. London 1911.

—— The corrosion of iron and steel. pp. xiv + 300. London 1911.

Gabb, *George Hugh.* A recently discovered portrait of Dr. Jeffries, by J. Russell, R.A. (From the *Connoisseur*, 1911, **29.**)

Gaebel, *Gustav Otto.* Das Reischauersche Titrationsverfahren zur Bestimmung des Harnzuckers. (From the *Apoth. Zeit.*, 1910, **25.**)

Gallerani, *Guido Tartarini.* See **Venturoli,** *Giuseppe.*

Gault, *H.* See **Richter,** *Victor von.*

Gazzetti, *C.*, and **Sarti,** *C.* Intorno ad una reazione rossa del reattivo di Esbach. (From the *Arch. farm. sperim. Sci.*, 1910, **9.**)

Geber. See **Braccesco,** *Giovanni.*

—— See **Salmon,** *William.*

Gildemeister, *Eduard,* and **Hoffmann,** *Friedrich.* Die ätherischen Öle. 2nd edition. Vol. I. pp. viii + 697. Leipzig 1910.

Glikin, *W.* Kalorimetrische Methodik. Ein Leitfaden zur Bestimmung der Verbrennungswärme organischer Körper, einschliesslich Nahrungsstoffe und Stoffwechselprodukte und zur Messung der tierischen Wärmeproduktion. pp. vii + 208. ill. Berlin 1911.

Gmelin, *Leopold,* and **Kraut,** *Karl Johann.* Handbuch der anorganischen Chemie. 7th edition. Edited by **Friedheim,** *Carl,* and **Peters,** *Franz.* Vol. I., etc. Heidelberg 1905 +. *Reference.*

Goldschmidt, *F.* See **Ubbelohde,** *L.*

Goodwin, *W.* See **Barthel,** *Chr.*

Graebe, *Carl.* Untersuchungen über Chinone. Edited by *Herman* **Decker.** pp. viii + 672. Portraits. Leipzig 1911. (*Reference.*)

Gray, *George.* On the dissolved matter contained in rain water collected at Lincoln, New Zealand. (From the *Canterbury Agric. Coll. Mag.*, 1910).

Gredinger, *Wilhelm.* See **Stift,** *Anton.*

Gross, *Oscar.* Untersuchungen über das Verhältniss von Stickstoff zu Schwefel im Stoffwechsel. (From the *Zeitsch. exp. Path. Ther.*, 1911, **9.**)

H., *J.* See **Valentinus,** *Basilius.*

Hämäläinen, *Juho.* Über das Schicksal des Cineols (Eukalyptols) im Organismus. (From the *Skand. Arch. Physiol.*, 1910, **24.**)

Hämäläinen, *Juho,* and **Sjöström,** *Lennart.* Über den Umfang der Glykuronsäurepaarung bei enzymimmunisierten Kaninchen. (From the *Skand. Arch. Physiol.*, 1910, **24.**)

Hall, *William T.* See **Ostwald,** *Wilhelm.*

Harbord, *Frank William.* See **Roberts-Austen,** *Sir William Chandler.*

Harden, *Arthur.* Alcoholic fermentation. pp. ix + 128. London 1911.

—— See **Roscoe,** *The Right Honourable Sir Henry Enfield.*

Hedley, *Edgar Percy.* See **Werner,** *A.*

Heiduschka, *Alfred,* and **Biéchy,** *Theodor.* Bestimmung des Arsens im Harn nach Anwendung von Salvarsan. (From the *Apoth. Zeit.*, 1911.)

Henderson, *Velyen E.* Hemmung der Wirkung chemischer Muskelreize durch Anelektrolyte. (From the *Zentr. Physiol.*, 1910, **24.**)

Hermes Trismegistus. See **Salmon,** *William.*

Higgins, *William.* An essay on the theory and practice of bleaching, wherein the sulphuret of lime is recommended as a substitute for pot-ash. pp. xxxii + 71. London 1799.

Hilditch, *Thomas Percy.* A concise history of chemistry. pp. ix + 263. London 1911.

Höber, *Rudolf.* Physikalische Chemie der Zelle und der Gewebe. 3rd edition. pp. xv + 671. Leipzig 1911.

Hoffmann, *Friedrich.* See **Gildemeister,** *Eduard.*

Hopkins, *Cyril George.* Soil fertility and permanent agriculture. pp. xxiii + 653. ill. Boston 1910.

Houston, *A. C.* See **Metropolitan Water Board.**

Huppert, *Karl Hugo.* See **Neubauer,** *Carl Theodor Ludwig.*

Indian Guild of Science and Technology. Year Book 1911. pp. 135. ill. Letchworth 1911.

International Congress of Applied Chemistry, VII. London, 1909. [Proceedings, etc.] 18 vols. London 1910. (*Reference*).

Jago, *William*, and **Jago,** *William C.* The technology of bread-making. Including the chemistry and analytical and practical testing of wheat, flour, and other materials employed in bread-making and confectionery. pp. viii + 908. ill. London 1911.

Javillier, *M.* Sur les silicotungstates de conicine, de spartéine et d'atropine. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

Jörgensen, *Alfred.* Micro-organisms and fermentation. Translated by *Samuel Henry* **Davies.** 4th edition. pp. xi + 489. London 1911

Kalid Ben Jazichi. See **Salmon,** *William.*

Keane, *Charles Alexander.* See **Lunge,** *George.*

Kinoshita, *Tosaku.* Über das Auftreten und die quantitative Bestimmung des Trimethylamins im menschlichen Harn. (From the *Zentr. Physiol.*, 1910, **24**.)

Knecht, *Edmund,* **Rawson,** *Christopher*, and **Loewenthal,** *Richard.* A manual of dyeing. 2nd edition. 2 vols. pp. xii + 902. ill. London 1910.

Körner, *Wilhelm.* Über die Bestimmung des chemischen Ortes bei den aromatischen Substanzen. (Ostwald's *Klassiker*, No. 174.) Leipzig 1910.

Kopp, *Hermann.* Die Entwickelung der Chemie in der neuren Zeit. pp. xxii + 854. München 1873.

Kraft, *F.* Die Glykoside der Blätter der Digitalis purpurea. (From the *Schweiz. Wochensch. Chem. Pharm.*, 1911.)

Lange, *Hans.* Studien über die Zusammensetzung heliumführender Mineralien. (From the *Zeitsch. Naturwiss. Halle*, 1910, **82**.)

Lauder, *Alexander, and* **Fagan,** *Thomas Wallace.* The variation in the composition of milk. Fifth annual report. pp. 42. Edinburgh 1911.

Lavoisier, *Antoine Laurent.* Traité élémentaire de chimie, présenté dans un ordre nouveau et d'après les découvertes modernes. 2nd edition. pp. xliv + 322, viii + 327. Paris 1793.

Lewis, *Samuel Judd.* Studien über das elementare Zirkonium. pp. 77. Stuttgart 1910.

Ley, *H.* Die Beziehungen zwischen Farbe und Konstitution bei organischen Verbindungen. Unter Berücksichtigung der Untersuchungsmethoden. pp. viii + 246. ill. Leipzig 1911.

Local Government Board. Reports of Inspector of Foods. Nos. 1 to 16. London 1906–1911. (*Reference.*)

Loew, *Oscar.* Über die physiologische Rolle der Kalziumsalze. (From the *Münch. Med. Woch.* 1910.)

Loew, *Oscar*. Über die Wirkung von Strontiumsalzen auf Algen. (From *Flora*, 1911, **102**.)

Loew, *Oscar*, and **Bokorny**, *Th*. Aktives Eiweiss und Tannin in Pflanzenzellen. (From *Flora*, 1911, **102**.)

Loewenthal, *Richard*. See **Knecht**, *Edmund*.

Lunge, *George*. [Editor.] Technical methods of chemical analysis. English translation from the latest German edition, adapted to English conditions of manufacture, edited by *Charles Alexander* **Keane**. Vol. II, in two parts. pp. xxvii + 1252. ill. London 1911.

—— The manufacture of sulphuric acid and alkali, with the collateral branches. Vol. III. Ammonia-soda, various processes of alkali making and the chlorine industry. 3rd edition. pp. xix + 764. London 1911.

Martindale, *W. Harrison*, and **Westcott**, *W. Wynn*. "Salvarsan" or "606" (Dioxy-diamino-arsenobenzol). Its chemistry, pharmacy, and therapeutics. pp. xv + 77. London 1911.

Masoni, *Giulio*. Saggio sull' azione del solfato di Manganese in rapporto alla vegetazione. (From the *Staz. sper. agrar. ital.*, 1911, **44**.)

Mastin, *John*. The chemistry, properties and tests of precious stones. pp. vi + 114. London 1911.

May, *Percy*. The chemistry of synthetic drugs. pp. xiii + 229. London 1911.

Meldola, *Raphael*. Evolution: Darwinian and Spencerian. The Herbert Spencer Lecture . . . 1910. pp. 44. Oxford 1910.

Mennicke, *Hans*. Die Metallurgie des Wolframs mit besonderer Berücksichtigung der Elektrometallurgie sowie der Verbindungen und Legierungen des Wolframs samt seinen Verwendungen. pp. ii + 416. ill. Berlin 1911.

Menschutkin, *Boris N*. Life and work of N. A. Menschutkin. pp. viii + 376. ill. 1908. [In Russian.]

Menschutkin, *Nikolai Alexandrovich*. See **Menschutkin**, *Boris N*.

Metropolitan Water Board, Sixth Report on research work. By *A. C.* **Houston**. pp. 18. London 1910.

Miculicich, *Miroslav*. Über den Einfluss von Elektrolyten und Anelektrolyten auf die Permeabilität der roten Blutkörperchen. From the *Zentr. Physiol.*, 1910, **24**.)

Millington, *J. P*. See **Blücher**, *H*.

Mingaye, *John C. H.*, and **White**, *Harold P*. Analyses of artesian and sub-artesian waters in New South Wales. pp. 8. Sydney 1911.

Mitchell, *Charles Ainsworth*. See **Simmons**, *William Herbert*.

Moreau, *B*. Analyse qualitative d'une mélange de sels, de recherche particulièrement difficile. (From the *Bull. Sci. Pharm.*, 1910.)

Müller, *Ernst Wolfgang.* See **Zeitschrift für angewandte Chemie.**

Nernst, *Walter.* Theoretical chemistry from the standpoint of Avogadro's rule and thermodynamics. Revised in accordance with the sixth German edition by *Henry Thomas* **Tizard.** pp. xix + 810. London 1911.

Neubauer, *Carl Theodor Ludwig,* and **Huppert,** *Karl Hugo.* Analyse des Harns. 11th edition. 1st half. pp. xiv + 682. ill. Wiesbaden 1910.

Nikaido, *Y.* Beet-sugar making and its chemical control. pp. xii + 354. ill. Easton, Pa. 1909.

Ostwald, *Wilhelm.* Introduction to chemistry. Authorized translation by *William T.* **Hall** and *Robert S.* **Williams.** pp. ix + 368. ill. New York 1911.

Ostwald's Klassiker. See **Körner,** *Wilhelm.*

Paderi, *Cesare.* Richerche sulle proprietà biologiche dell' acido glicuronico. I. (From the *Arch. Farm. sperim. Sci.,* 1911, **11.**)

Paris, *John Ayrton.* The life of Sir Humphry Davy. 2 vols. pp. xvi + 416, viii + 463. London 1831.

Partington, *J. Riddick.* Higher mathematics for chemical students. pp. iv + 272. London 1911.

Pellatt, *Apsley.* Curiosities of glass-making. With details of the processes and productions of ancient and modern ornamental glass manufacture. pp. vi + 146. ill. London 1849.

Peters, *Franz.* See **Gmelin,** *Leopold.*

Philippine Islands. The mineral resources of the Philippine Islands. With a statement of the production of commercial mineral products during the year 1909. pp. 81. ill. Manila 1910.

Piccinini, *Guido M.* Il metabolismo del manganese e la legge del minimo tra manganese e ferro. (From the *Arch. Farm. sperim. Sci.,* 1910, **10.**)

—— Il manganese come attivatore o cinasi non specifica e il Manganese colloidale. (From the *Biochem. Terap. sperim.,* 1910, **2.**)

Pohl, *Julius.* Experimenteller Beitrag zum Oxalsäurestoffwechsel. (From the *Zeitsch. exp. Path.,* 1910, **8.**)

Prandi, *Oreste,* and **Civetta,** *Angelo.* Il manganese nel vino. (From the *Staz. sper. agrar. ital.,* 1911, **44.**)

Pusa Agricultural Research Institute and College. Report 1909–10. pp. 69. Calcutta 1910.

Queensland, Report of the Agricultural Chemist for the year ending 30th June, 1910. pp. 23. Brisbane 1910.

Rankin, *George A.* See **Shepherd,** *Ernest S.*

Rassow, *Berthold.* See **Zeitschrift für angewandte Chemie.**

Rawson, *Christopher.* See **Knecht,** *Edmund.*

Redgrove, *Herbert Stanley.* Alchemy: ancient and modern. Being a brief account of the alchemistic doctrines, and their relations, to mysticism on the one hand, and to recent discoveries in physical science on the other hand; together with some particulars regarding the lives and teachings of the most noted alchemists. pp. xiv + 141. ill. London 1911.

—— On the calculation of thermo-chemical constants. pp. viii + 102. London 1909.

Redwood, *Sir Boverton.* Petroleum. A treatise on the geographical distribution and geological occurrence of petroleum and natural gas; the physical and chemical properties, production, and refining of petroleum and ozokerite; the characters and uses, testing, transport, and storage of petroleum products; and the legislative enactments relating thereto; together with a description of the shale oil and allied industries; and a full bibliography. 2 vols. pp. xxxii + 1064. ill. London 1906.

Richter, *Victor von.* Traité de chimie organique. Edited by *R.* **Anschütz** and *G.* **Schroeter.** Translated into French by *H.* **Gault.** Vol. I. pp. xxiv + 886. Paris 1910.

Rideal, *Samuel.* Disinfection and the preservation of food. Together with an account of the chemical substances used as antiseptics and preservatives. 3rd edition. pp. xii + 494. ill. London 1903.

Roberts-Austen, *Sir William Chandler.* An introduction to the study of metallurgy. 6th edition, revised and enlarged by *F. W.* **Harbord.** pp. xv + 478. ill. London 1910.

Roscoe, *The Right Honourable Sir Henry Enfield,* and **Harden,** *Arthur.* Inorganic chemistry for advanced students. 2nd edition. pp. viii + 476. ill. London 1910.

Roscoe, *The Right Honourable Sir Henry Enfield,* and **Schorlemmer,** *Carl.* A treatise on chemistry. Vol. I. The non-metallic elements. New edition completely revised by *Sir H. E.* **Roscoe,** assisted by *J. C.* **Cain.** pp. xii + 955. ill. London 1911. (*Reference.*)

Rossitz Experimental Station. Reports on the Austrian coaldust experiments 1908–1909. Abstracted and translated by the *Colliery Guardian* from the *Oesterreichische Zeitschrift für Berg- und Hüttenwesen.* pp. 36. London 1911.

Royal Society of London. Catalogue of a collection of early printed books in the Library. pp. 120. London 1910.

Sadtler, *Samuel S.* See **Allen,** *Alfred Henry.*

Salmon, *William.* Medicina Practica: or, the Practical Physician: Shewing the true method of curing the most usual diseases incident to human bodies. . . To which is added, the chymical works of Hermes

Trismegistus, Kalid King of Persia, Geber King of Arabia, Artefius Longævus the Jew, Roger Bacon, Nicholas Flammel's Hieroglyphicks. George Ripley's Marrow of Alchymie. And an account of their lives. pp. [xxviii] + 696. ill. London 1707. (*Reference.*)

Sarti, *C.* See **Gazzetti**, *C.*

Scheithauer, *W.* Die Schwelteere, ihre Gewinnung und Verarbeitung. pp. viii + 192. Leipzig 1911.

Schidrowitz, *Philip.* Rubber. pp. xv + 303. ill. London 1911.

Schoeller, *Walter.* See **Schrauth**, *Walther.*

Schorlemmer, *Carl.* See **Roscoe**, *The Right Honourable Sir Henry Enfield.*

Schrauth, *Walther*, und **Schoeller**, *Walter.* Über die Desinfektionskraft komplexer organischer Quecksilberverbindungen. I. Aromatischer Quecksilbercarbonsäuren. (From the *Zeitsch. Hyg. Infect.*, 1910, **66**.)

Schroeter, *G.* See **Richter**, *Victor von.*

Scott, *Alexander.* An introduction to chemical theory. 2nd edition. viii + 272. London 1911.

Seeligmann, *Franz*, and **Zieke**, *Emil.* Handbuch der Lack- und Firnis-Industrie. pp. xvi + 953. ill. Berlin 1910.

Seidell, *Atherton.* The solubilities of the pharmacopœial organic acids and their salts. pp. 98. Washington 1910.

Senter, *George.* Outlines of physical chemistry. 2nd edition. pp. xvii + 387. ill. London 1911.

—— Text-book of inorganic chemistry. pp. x + 583. ill. London 1911.

Shaw, *Peter.* See **Boyle**, *Robert.*

Shepherd, *Ernest S.*, and **Rankin**, *George A.* Preliminary report on the ternary system CaO–Al_2O_3–SiO_2. A study of the constitution of Portland cement clinker. With optical study by *Fred. E.* **Wright**. (From the *J. Ind. Eng. Chem.*, 1911, **3**.)

Shrivell, *F. W. E.* See **Dyer**, *Bernard.*

Simmons, *William Herbert*, and **Mitchell**, *Charles Ainsworth.* Edible fats and oils. Their composition, manufacture and analysis. pp. viii + 150. London 1911.

Sindall, *Robert Walter.* See **Cross**, *Charles Frederick.*

Sjöström, *Lennart.* See **Hämäläinen**, *Juho.*

Spencer, *James Frederick.* An experimental course of physical chemistry. Part I. Statical experiments. pp. xiv + 228. ill. London 1911.

Stegmüller, *Ph.* See **Beck**, *Karl.*

Stift, *Anton*, and **Gredinger**, *Wilhelm.* Der Zuckerrübenbau und die Fabrikation des Rübenzuckers. pp. viii + 667. ill. Wien 1910.

Stoddart, *Frederick Wallis.* Nitrification and the absorption theory. An account of the principles of the modern sewage filter. pp. 24. Bristol 1911.

Sundwik, *Ernst Edw.* Xanthinstoffe aus Harnsäure. (From the *Skand. Arch. Physiol.*, 1911, **25**.)

Taffanel, *J.* Abstract of the reports of the French coaldust experiments conducted at the Liévin Experimental Station, 1907–10. Abstracted and translated by the "Colliery Guardian." pp. 82. ill. London 1910.

Tesdorpf, *Theodor.* See **Autenrieth,** *Wilhelm.*

Thiel, *A.* Der Stand der Indikatorenfrage. Zugleich ein Beitrag zur chemischen Theorie der Farbe. (Sammlung, Vol. XVI.) Stuttgart 1911.

Thole, *Ferdinand Bernard.* See **Dunstan,** *Albert Ernest.*

Thunberg, *Torsten.* Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. IV—X. (From the *Skand. Arch. Physiol.*, 1910, **24**, 1911, **25**.)

—— Untersuchungen über autoxydable Substanzen und autoxydable Systeme von physiologischem Interesse. I. and II. (From the *Skand. Archiv. Physiol.*, 1910, **24**.)

Tigerstedt, *Robert.* Zur Kenntnis der Aschebestandteile in der frei gewählten Kost des Menschen. (From the *Skand. Arch. Physiol.*, 1910, **24**.)

Tizard, *Henry Thomas.* See **Nernst,** *Walter.*

Trier, *Georg.* See **Winterstein,** *Ernst.*

Trinum Chymicum oder Drey Chymische Tractätlein. I. Fr. Vincentii Koffsky . . . Schöner und ausführlicher Bericht von der ersten Tinctur-Wurzzel des Steins der Weisen, *etc.* (pp. 1—21 only). Strassburg 1699. (*Reference.*)

Trinum Chymicum secundum oder Drey Andere Chymische Tractätlein. I. Heinrici Khunrath . . . Philosophische Erklärung von und über dem geheimen äusserlichen sichtbaren Gludt und Flammen-Feur der uhralten Magorum oder Weysen und anderer wahren Philosophen. II. Ein fürtreffliches Judicium und Bericht eines erfahrnen Cabalisten, über die vier Figuren dess grossen Amphitheatri D. Henrici Khunrathi. III. Von der Tinctur Antimonii und Oleo Stibii von Theophrasto Paracelso Auch einem Anhang zu der Materi dienlichen Sachen Von Basilio Valentino beschrieben. pp. [viii]+174 (misprint for 184). Strasburg 1700. (*Reference.*)

Tutton, *Alfred Edwin Howard.* Crystallography and practical measurement. pp. xiv+946. ill. London 1911.

Ubbelohde, *L.*, and **Goldschmidt,** *F.* Handbuch der Chemie und

Technologie der Öle und Fette. Vol. III, part 2. pp. xiv + 381 to 1195. ill. Leipzig 1911.

Valentinus, *Basilius.* His last Will and Testament . . . , wherein he . . . declareth the wayes he wrought to obtain the Philosophers Stone, *etc.* London 1657—56. (9 parts, each having separate title-page. Wanting first title-page, and pp. 21 to 23 of a "Treatise concerning Microcosme.") (*Reference.*)

—— The triumphant chariot of antimony, being a conscientious discovery of the many reall transcendent excellencies included in that minerall. Faithfully Englished and published for the common good by J. H. *Oxon.* Printed for Thomas Bruster, and are to be sold at the three Bibles neere the West end of Paules Church-Yard in London, 1660.

A rare first edition not mentioned in the bibliographies and differing from the 1661 edition in date and publisher.

Venturoli, *Giuseppe,* and **Gallerani,** *Guido Tartarini.* Contributo allo studio chimico-tossicologico dell' Adrenalina. (From the *Giorn. Farm. Chim.*, 1911, **60**.)

Wadmore, *John Mello.* Elementary chemical theory. pp. xi + 275. London 1911.

Walter, *Johann.* Einige Notizen über die zwischen aromatischen Amino- und Nitrokörpern auftretenden Färbungen. (From the *Zeitsch. Farb.-Ind.*, 1911.)

Wehmer, *C.* Die Pflanzenstoffe. Chemische Bestandteile und Zusammensetzung der einzelnen Pflanzenarten, Rohstoffe und Produkte. pp. xvi + 937. Jena 1911.

Weimarn, *P. P. von.* Grundzüge der Dispersoidchemie. pp. viii + 127. ill. Dresden 1911.

Werner, *A.* New ideas on inorganic chemistry. Translated by *Edgar Percy* **Hedley.** pp. xvi + 268. London 1911.

Westcott, *W. Wynn.* See **Martindale,** *W. Harrison.*

White, *George F.* See **Bingham,** *Eugene C.*

White, *Harold P.* See **Mingaye,** *John C. H.*

Widmark, *Erik M. P.* Untersuchungen über die chemischen Bedingungen für das Beibehalten der normalen Struktur der Zellen. I. and II. (From the *Skand. Archiv. Physiol.*, 1910, **23, 24**.)

Williams, *Robert S.* See **Ostwald,** *Wilhelm.*

Winterstein, *Ernst,* and **Trier,** *Georg.* Die Alkaloide. pp. vii + 340. Berlin 1910.

Worden, *Edward Chauncey.* Nitrocellulose industry. A compendium of the history, chemistry, manufacture, commercial application and analysis of nitrates, acetates and xanthates of cellulose. . . . With a chapter on guncotton, smokeless powder and explosive cellulose

nitrates. 2 vols. pp. xxxiv + 566, xxviii + 567 to 1239. London 1911.

Wright, *Fred E.* See **Shepherd,** *Ernest S.*

Zacharias, *Johannes.* Elektrochemische Umformer [Galvanische Elemente]. pp. xii + 262. ill. Wien 1911.

Zeitschrift für angewandte Chemie. General Register. Jahrgänge 1887 bis 1907. Edited by *Berthold* **Rassow** and *Ernst Wolfgang* **Müller.** pp. iv + 609. Leipzig 1910. (*Reference.*)

Zenneck, *J.* Die Verwertung des Luftstickstoffs mit Hilfe elektrischen Flammenbogens. pp. 29. ill. Leipzig 1911.

Zieke, *Emil.* See **Seeligmann,** *Franz.*

INDEX TO AUTHORS' NAMES.

Adlam, G. H. J., 17.
Allmand, A. J., 69, 70.
Andrews, A. E., 248.
Ark, H., 223.
Austin, P. C., 24.

Bagster, L. S., 141.
Baker, H. B., 17, 187.
Baly, E. C. C., 72.
Banerjee, M. N., 234, 326.
Banerjee, S. C., 326.
Barger, G., 258, 305.
Barker, T. V., 158, 198.
Barnett, E. de B., 8, 120.
Barrett, W. H., 100.
Barrow, F., 232.
Bassett, H., jun., 155.
Beard, S. H., 5.
Bearder, E. A., 228.
Berry, A. J., 56.
Bevan, E. J., 149.
Blanc, G. L., 265.
Bland, N., 59.
Boon, A. A., 197.
Borar, D., 128.
Bousfield, W. R., 187.
Bowden, R. C., 5.
Boyd, R., 276.
Boyle, M. (Miss), 9.
Brady, O. L., 94.
Briggs, S. H. C., 24.
Brown, J. H., 124, 156.
Burger, O. K. H., 160.
Burgess, M. J., 70, 262.

Callan, T., 257.
Cardell, I. S., 138.
Caven, R. M., 147.
Challenger, F., 66.
Chapman, D. L., 56, 223, 224.
Chattaway, F. D., 193, 280.
Chou, T. Q., 2, 57.
Christopher, H., 236, 265, 312.
Clarke, C. H., 22.
Clarke, H. T., 212, 243.
Clarke, R. (Miss), 260.
Clayton, A., 233, 245.
Clayton, E. G., 229.
Clewer, H. W. B., 89.
Cohen, J. B., 123.
Cooke, W. T., 42.
Cooper, W. F., 134.
Crocker, J. C., 22.
Crompton, H., 165.
Cross, C. F., 149.
Crossley, A. W., 90, 137, 307.
Crymble, C. R., 46, 68, 153, 328.
Cumming, C. L., 193.

Datta, K. L., 127, 264.
Davies, H., 39.
Dawson, H. M., 208, 223.
Deakin, S. (Miss), 316.
Dobbie, J. J., 90, 148, 217, 325.
Dobson, B. (Miss), 4.
Dodgson, J. W., 260.
Donnan, F. G., 70, 209, 213, 216.
Dreaper, W. P., 244.
Dunn, F. P., 239.
Dunstan, A. E., 59, 93, 233.
Dunstan, W. R., 221, 222.

Easterfield, T. H., 279.
Edwards, M. G. (Miss), 120, 121.
Egerton, A. C. G., 189.
Emmett, W. G., 72.
Evans, P. E., 43.
Everest, A. E., 209, 218, 285.
Ewins, A. J., 20, 45, 259, 277, 305.

Fairlie, D. M., 217, 305.
Findlay, A., 189.
Firth, J. B., 96, 139, 237.
Forster, M. O., 19, 50, 154, 195, 206, 259, 327.
Forsyth, W. C., 320.
Fox, J. J., 90, 136, 217, 325.
Francis, A. G., 44.
Francis, F., 22.
Frankland, E. P., 206, 207, 309, 320.
Frankland, P. F., 319.
Friend, J. A. N., 124, 156, 311.
Funk, C., 56.

Gauge, A. J. H., 90, 136, 217.
Gee, F. H., 56, 223.
Gelderen, F. M. van, 19, 195.
Glendinning, W. G., 46.

Goulding, E., 235.
Green, A. G., 228.
Green, L. (Miss), 140.

Hackford, J. E., 8.
Hampshire, C. H., 90.
Harcourt, A. G. V., 187.
Harden, A., 103.
Harding, V. G., 12, 213.
Hardman, R. T., 221, 244.
Harris, A. B., 209.
Hartley, E. G. J., 211.
Hartley, H., 100.
Hartley, W. N., 137.
Haworth, W. N., 4.
Heilbron, I. M., 248, 249, 315.
Henderson, G. G., 211, 248, 249, 276, 277.
Hicks, W. L., 102.
Higgins, S. H., 67, 314.
Hilditch, T. P., 3, 6, 44, 93, 123, 139, 311, 312.
Hill, J. R., 221, 222.
Holt, A., 21.
Hope, E., 95, 125, 265, 281.
Hopwood, A., 55, 214.
Howard, H., 52, 206.
Hughes, E. C., 190.
Hull, T. E., 124.
Hurtley, W. H., 2.
Hynd, A., 9, 23.

Inglis, J. K. H., 46.
Irvine, J. C., 9, 23.

Jackson, C. G., 45.
James, T. C., 216.
Jones, H. E., 224.
Jones, H. O., 43, 72, 279.
Jones, W. J., 21, 100, 143.
Joyner, R. A., 5.

Keane, C. A., 44.
Kenyon, J., 312, 324.
Kenner, J., 92, 262.
King, H., 120, 139, 196, 266.
Kipping, F. S., 8, 39, 66, 143.
Kuntzen, H., 157, 263.

Lang, W. R., 140, 161.
Lankshear, F. R., 166, 224.
Lapworth, A., 100, 143, 194, 224, 239, 240, 244.
Lauder, A., 148.
Law, H. D., 138, 310.
Laws, E. G., 263.
Le Bas, G., 196.
Leete, H., 120.
Leslie, M. S. (Miss), 208.
Le Sueur, H. R., 104.
Lewis, W. C. M., 266.
Little, O. H., 137.
Littlebury, W. O., 324.
Lloyd, H., 161.
Long, F. S., 283.
Loram, H. Y., 60.
Lowry, T. M., 187.
Luff, B. D. W., 57.

McCleland, N. P., 224.
McCombie, H., 209, 218.
McKenzie, A., 150, 232
Maclaurin, J. S., 10.
McNicoll, D., 23.
Marsden, E. G. (Miss), 207.
Marsh, J. E., 283, 317, 328.
Masson, J. I. O., 125, 328.
Matthews, F., 22.
May, P., 124, 141.
Meldola, R., 98, 157, 263.
Meldrum, A. N., 216.
Merriman, R. W., 64, 65, 101.
Merton, T. R., 66.
Micklethwait, F. M. G. (Miss), 274 326
Moir, J., 226.
Montgomerie, H. H., 276
Moore, C. W.,42, 118, 119, 157.
Morgan, G T., 233, 274, 326.
Morrell, G. F., 307.
Müller, H., 101.
Mussell, A. G., 59.
Myers, J. E., 21, 96, 139.

Naunton, W. J. S., 309.
Neogi, P., 71, 208, 242.
Newman, S. H., 19, 154.
Nuttall, W. H., 134.

Östling, G. J., 315.
O'Sullivan, H. H., 319.
Orton, K. J. P., 120, 121, 139, 196.

Paine, S. G., 103.
Paniker, R., 213.
Parry, W., 141.
Partington, J. R., 12, 13, 14, 45, 194, 221, 247.
Patterson, T. S., 276, 320.
Peddle, C. J., 8.
Pelly, R. G., 235.
Perkin, A. G., 194, 225.
Perkin, W. H., jun., 4, 57, 59, 95, 101, 166, 212.
Perman, E. P., 7, 94.
Pickard, R. H., 312, 324.
Pickering, S. U., 7, 55, 192, 276.
Pickford, P., 127.
Pickles, S. S., 54, 220, 284, 285.
Pope, F. G., 52, 73, 206.
Pope, W. J., 212, 259.
Porter, A. W., 119.
Power, F. B., 53, 118, 257, 304.

Prescott, W. G., 65, 317.
Prideaux, E. B. R., 121.
Pring, J. N., 217, 305.
Purvis, J. E., 71, 218, 242, 280.
Pyman, F. L., 45, 91, 92, 206, 215, 275.

Rakshit, J. N., 22, 71, 122, 220, 264, 291.
Ray, P. C., 4, 22, 71, 121, 122, 127, 220, 264, 291.
Rea, F. W. (Miss), 153.
Read, J., 259.
Remfry, F. G. P., 20, 72.
Rennie, E. H., 42.
Renouf, N. (Miss), 137.
Reynolds, W. C., 306.
Rhead, T. F. E., 126.
Rivett, A. C. D., 316.
Roberts, W. M., 57.
Robinson, C. S., 279.
Robinson, H. H., 247.
Robinson, R., 57, 59, 101, 125, 265.
Rogerson, H., 304.
Romburgh, P. van, 258.
Roshdestwensky, A., 266.
Ruhemann, S., 97, 163, 210, 309.
Rule, A., 60.

Salway, A. H., 20, 53, 191, 273.
Sand, H. J. S., 147.
Sanders, J. M., 250, 329.
Schwers, F., 208.
Segaller, D., 283.
Sell, W J., 220.
Sen, H. K., 4, 121.
Senier, A., 260.
Senter, G., 119.
Shaw, W. B., 14, 98.
Shen, B., 189.
Sidgwick, N. V., 127, 263.
Simonsen, J. L., 194.
Slade, R. E., 242.
Smedley, I. (Miss), 208.
Smiles, S., 3, 44, 65, 123, 207, 212, 265, 317.
Smith, H. E., 320.
Starling, W. W., 258.
Steele, V., 239, 240.
Stewart, A. W., 46, 153.
Stiasny, E., 213.
Stötter, H., 206.
Stubbs, C. M., 225.
Sudborough, J. J., 5, 279, 314.
Sutherland, B. (Miss), 140.
Sutherland, M. M. J. (Miss), 211, 277.

Taylor, C. M. (Miss), 279.
Taylor, H. S., 155.
Taylor, R. L., 243.
Taylor, W. H., 306.
Thole, F. B., 42, 122, 219, 233, 252, 278.
Thomas, E. R., 279, 314.
Thomas, F., 138.
Thomas, J. S., 213.
Thompson, H. V., 155.
Thorpe, J. F., 42, 122, 128, 219, 252, 265.
Tinkler, C. K., 162.
Titherley, A. W., 102, 190.
Trotter, J. R., 259.
Turner, E. G. (Miss), 92, 262.
Turner, W. E. S., 8, 40.
Tutin, F., 89, 149.
Tyrer, D., 96, 142, 215, 319.

Veley, V. H., 3.

Wade, J. W., 64, 65.
Walker, M. (Miss), 165.
Wallach, O., 4.
Walsh, G. M. (Miss), 12.
Watson, E. R., 163.
Watson, H E., 135.
Weintroube, J., 259.
Weir, J., 154.
Weizmann, C., 12, 55, 214.
Wheeler, R. V., 70, 126, 262.
White, A. S., 216.
Whitfeild, B. W., 54.
Wilks, W. A. R., 308.
Wilsdon, B. H., 127, 193.
Wilson, F. J., 197, 315.
Withers, J. C., 327.
Wootton, W. O., 2.
Wren, G. H. (Miss), 307.
Wright, R., 46, 153.
Wünsch, D. F. S., 193.

Zimmerli, A., 50.

INDEX TO DISCUSSIONS.

Baker, H. B., 19.

Cohen, E., 187.
Cross, C. F., 135.

Dixon, H. B., 18, 51, 64.

Ewins, A. J., 20.

Forster, M. O., 52, 65.
Fox, J. J., 136.
Frankland, P. F., 67, 91, 151, 232.

Green, A. G., 52, 53.
Guttmann, L. F., 188.

Hurtley, W. H., 3.

Lessing, R., 19.
Lowry, T. M., 51, 67, 189.

McKenzie, A., 39, 232.
Merton, T. R., 66.
Morgan, G. T., 275, 308.

Nuttall, W. H., 135.

Philip, J. C., 41.
Pickles, S. S., 54.
Pyman, F. L., 135, 275.

Ramsay, Sir W., 41.
Reynolds, W. C., 307.
Robertson, W., 51.

Salway, A. H., 274.
Scott, A., 307.
Senter, G., 18, 153.

Titherley, A. W., 188, 192.
Turner, T., 306.
Turner, W. E. S., 41.

Veley, V. H., 51, 188, 274, 306.

Wade, J., 65, 136, 188.
Watson, H. E., 136.

INDEX OF SUBJECTS.

Absorption spectra. See under Photochemistry.
Acenaphthene, nitro-, reduction of, 165.
Acetaldehydephenylhydrazones, isomeric, 263.
Acetic acid, purification of, 120.
purification and properties of, 187.
detection and estimation of acetic anhydride in, 121.
cyano-, ethyl ester, condensation of camphorquinone with, 327.
Acetone, condensation of, in presence of phosphoric acid, 71.
electrochemistry of solutions in, 266.
4-Acetoxy-5-methoxy-β-phenylpropionic acid, 2-hydroxy-, lactone of, 119.
p-Acetoxystyrene, ω-nitro-, 21.
Acetyl chloride, condensation of salicylamide and, 102.
Acetylbenzoin, nitro-, 44.
Acids, fatty, α-bromo-, menthyl esters of, 312.
higher fatty, optically active derivatives of the, 311.
preparation of the ketones of, 279.
organic, esterification of, 314.
separation of mixtures of, by partial esterification, 279.
Acylanilides, chlorination of, 196.
Address to the Royal Academy of Sciences of Turin, 272.
congratulatory, to the King, 184.
to the University of St. Andrews, 185.
Affinity, Chemical:—
Kinetics of the reaction between silver nitrate and bromo-fatty acids, 119.
Residual affinity and chemical constitution, relation between, 243.
Velocity of addition of alkyl bromides to cyclic tertiary bases, 283.
Velocity of chlorination of anilides, relation of, to constitution, 196.
Affinity, Chemical:—
Velocity of reaction, application of viscometry to the measurement of, 59.
influence of neutral solvents on, 276.
of alkyl iodides with sodium phenoxide, 283.
between chemical compounds and living muscle-proteins, 3.
of solution of mercury in nitric acid, 4.
Air. See Atmospheric air.
Alcohols of the hydroaromatic and terpene series, 324.
higher fatty, optically active derivatives of the, 311.
secondary, rotations of, 324.
Aldehydes, aromatic, condensation of, with nitromethane, 20.
electrolytic reduction of, 138.
3- and 5-Aldehydosalicylic acids, and their nitro-derivatives and ethyl esters, 21.
*syn*Aldoximes, preparation of, 233.
Alizarin, occurrence of, in rhubarb, 101.
Alkalis, action of chlorine on, 243.
Alkyl bromides, velocity of addition of, to cyclic tertiary bases, 283.
iodides, interaction of sodium phenoxide and, 283.
Alkylglutaconic acids, reactions of the, 252.
Allium sativum (garlic) juice, action of, on lead and mercury, 234.
Allophanic acid, *iso*butyl ester, 73.
Alloxan, interaction of glycine and, 2.
relation of triketohydrindene hydrate, to, 97.
Amalgams. See Mercury alloys.
Amides, acid, 72.
Amines, secondary, preparation of, from carboxylic acids, 104.
Aminoalkylglyoxalines, 275.

Ammonia, synthesis of, by heat, 138.
action of radium on, 7.
Ammonias, substituted, metallic compounds of, 140.
Ammonium bases, preparation of the nitrites of, 242.
compounds, asymmetric quaternary, 157, 268.
solutions, studies of, 242.
cyanate, transformation of, into carbamide, 280.
N-Anhydrobenzoylaminolauronic acid, 154.
N-Anhydrocarboxymethylaminolauronic acid, 154.
Anhydrocotarninephthalide, 125.
Anhydromethylaminolauronic acid, 154.
Anilides, chlorination, of, 196.
Aniline, solubility of, in aqueous solutions of its hydrochloride, 127.
action of antimony chlorides on, 124.
effect of heat on a mixture of benzaldehydecyanohydrin and, 218.
hydrochloride, conductivity and viscosity of aqueous solutions of, 127.
p-chloro-, compound with antimony trichloride, 125.
Anilines, chlorination of, 139.
Anilinophenylacetonitrile, 218.
Anis*syn*aldoxime, transformation of, in various solvents, 276.
Annual General Meeting, 77.
Antimony organic compounds, 124, 274.
Apparatus for maintenance of constant pressures, 64.
for precipitating, filtering, and drying in an inert gas, 96.
for sublimation in a vacuum, 236.
Arylsulphon-anilides and β-naphthalides, amino-derivatives of, 326.
Asymmetry in the supposed absence of an asymmetric atom, 317.
Atmospheric air, volumetric estimation of oxygen in, 135.
Atomic weight of tellurium, 18.
Atomic weights, report of the International Committee on, 202.
table of, 205.
Autofermentation of yeast, influence of salts on the, 103.
Azoimide, sodium salt, interaction of nitrosates and, 19.

Base, $C_{12}H_{16}N_2$, from *Withania somnifera*, 53.
Bases, cyclic tertiary, velocity of addition of alkyl bromides to, 283.
Beer, solubility of carbon dioxide in, 189.
Benzaldehyde and 2-, 3-, and 4-nitro-, diphenylcarbamyloximes of, 239.
Benzaldehydecyanohydrin, effect of heat on a mixture of aniline and, 218.
Benzaldehydephenylhydrazone, preparation of labile, 278.
Benzene derivatives, absorption spectra of, 46, 218.
nucleus, orienting influence of antimonic substituents in the, 274.
bromo- and chloro-, absorption spectra of, 71.
chloro- and *di*chloro-, absorption spectra of, 72.
iodo-derivatives, absorption spectra of, 280.
*s-tri*nitro-, additive compounds of phenols and phenolic ethers with, 5.
Benzeneazocarbonylcoumaranone, and its silver derivative and hydrazone, 102.
Benzenesulphonic acid, 2 : 3 - *di*- and 2 : 3 : 4 : 5-*tetra*-iodo-, and their derivatives, 9.
Benzoic acid, fluoro- and iodo-derivatives, rotation of menthyl esters of, 123.
Benzoic acids, hydroxy-, oxidation products of, 194.
Benzoin nitrate, 44.
Benzoyldianilinostilbene, 219.
p-Benzoyloxybenzaldehyde and its oxime, phenyl- and *p*-nitrophenyl-hydrazones, 74.
p-Benzoyloxybenzonitrile, 74.
p-Benzoyloxybenzylidene-*p*-nitroaniline, 74.
p-Benzoyloxystyrene, ω-nitro-, 21.
Benzylamine, action of, on *s*-dibromosuccinic acid, 206.
Benzylaminobromosuccinic acid, benzylamine salt, 206.
Benzylammonium nitrite, 127, 242.
Benzyldiethylsilicol, 9.
Benzylethylpropylsilicol, 9.
Benzylidene bases, electrolytic reduction of, 310.
Benzylidenedeoxybenzoin, *m*-nitro-, semicarbazones of, 315.
Berberine, constitution of, 162.
βγ-Bis[4(or 5)-glyoxaline]propylamine, 275.
Bisnitrobenzeneazo-azobenzene, 229.
Bleaching powder, action of carbon dioxide on, 243.
Bleaching process, investigation of the, 314.
action of carbon dioxide in the, 67.
Books presented by the family of the late Dr. W. J. Russell, 131.
Bornylene, action of chromyl chloride, nitrous acid and nitric acid on, 248.
Brassidone and its oxime, 279.

Bryonol, and its diacetyl derivative, 118.
Bryony root, constituents of, 118.
Bupane distichu, constituents of the bulb of, 149.
Buphanine, 149.
Buphanitine and its hydrochloride and methiodide, 149.
Butylammonium nitrite, decomposition of, by heat, 291.
4(or 5)-Butylglyoxaline, γ-amino-, 275.

Caeruleocellagic acid and its acetyl and benzoyl derivatives, 194.
Cæsium magnesium chromate, 198.
Calabar beans, chemical examination of, 273.
Calabarol and its dibenzoyl derivative, 273.
Calcium hydroxide, absorption of the halogens by, 308.
Camphane series, studies in the, 50, 259, 327.
Camphane, *di*nitro-, 249.
Camphane-thiotriazine, 50.
Camphenanic acid, and its derivatives, 211. 278.
Camphene, constitution of, 249.
oxidation of. 211, 277.
*iso*Camphenilanaldehyde, 211.
*iso*Camphenilanic acid, bromo- and chloro-, 249.
Camphenylnitroamine, constitution of, 259.
Camphor, α'-derivatives of, 283.
Camphor, chloro-, 248.
*per*nitroso-, constitution of, 259.
Camphoric acid, Komppa's synthesis of, 265.
Camphorquinone, absorption spectra of the isomeric hydrazones and semicarbazones of, 224.
condensation of, with nitromethane, ethyl cyanoacetate and phenylacetonitrile, 327.
Camphorquinone-β-phenylhydrazone, -phenylthiocarbamylhydrazone and -a-thiosemicarbazone, 50.
Camphorylidenecyanoacetic acid, and its ethyl and methyl esters, 327.
Camphylic acid. See Camphenanic acid.
Candelilla wax, 250.
Carbamide, transformation of ammonium cyanate into, 280.
*di*chloro-, formation of, and its behaviour towards amines, 264.
Carbinols, asymmetric, 157, 263.
Carbethoxyl group, elimination of, as ethyl carbonate, 252.
Carbon *mon*oxide, interaction of chlorine and, 56, 223.
*di*oxide, solubility of, in beer, 189.
action of, in the bleaching process, 67.
action of, on bleaching powder, 243.
Carbonic acid, ethyl ester, elimination of a carbethoxyl group as, 252
Carbon, determination of, in organic compounds, 207, 309.
o-Carboxyanilides of the sugars, 9.
2'-Carboxy-2:5-*di*hydroxydiphenyl sulphide, 212.
Carboxymethylaminolauronic acid, 154.
o-Carboxyphenylglycollic acid, ethyl ester, and its monoamide, 102
Carvone hydrosulphide, action of hydrogen cyanide on, 240.
Casimiroa edulis, constituents of the seeds of, 257.
Casimiroedine, 258.
Casimiroic acid, and its derivatives, 258.
Casimiroine, 258.
Casimiroitine, 258.
Casimirolid, 258.
Catalytic agent, orthophosphoric acid as a, 71.
Catechol, 3:5-*di*nitro-, salts of, 14.
Catalysis, mechanism of negative, 119.
of silver nitrate, 24.
Cellulose, interaction of formic acid and, 149.
Cerotoneoxime, 279.
Certificates of candidates for election, 26, 106, 171 293.
Chemical action induced by cathode rays and canal rays, 94.
compounds, reactions between living muscle-proteins and, 3.
constitution, relation between velocity of chlorination of aromatic compounds and 196.
and hypnotic action, 72.
and residual affinity, relation between, 243.
dependence of rotatory power on, 324.
Chlorination, a method of, 139.
Chlorine, action of, on alkalis, 243.
interaction of carbon monoxide and, 56, 223.
Cholesterol and fatty acids, 14.
Cinchonine, absorption spectrum of, 148.
Cinnamic acid, 3:4-*di*hydroxy-, methyl ester, 304.
Cinnamic acids, β-chloro-, 216.
Cinnamoyl-*p*-aminoacetophenone, 72.
Citraconic acid, ethyl ester, condensation of ethyl sodiomalonate with, 281.

Coal, volatile constituents of, 70.
Cobalt sodium oxalate, stability of 260.
β- and γ-Coccinic acids, synthesis of the methyl ethers of, 216.
Committees, appointment of, by Council, 88.
Congo-red, osmotic pressure and conductivity of aqueous solutions of, 209.
Copper, interaction of nitric acid and, in presence of metallic nitrates, 42.
salts, behaviour of, with alkalis, 276.
benzoate, compounds of, with pyridine and quinoline, 94.
sulphate, action of sodium hypophosphite on, 139.
cupric bromide, dissociation of, 45.
cupricarbonates of potassium, 55.
cupriglycollates, 192.
cupritartrates, 7.
cuprous-ammonia complex, composition of the, 213.
cuprous oxide, solubility of, in aqueous ammonia solutions, 213.
cuprous thiocyanate, compound of trimethylamine and, 140.
Copper organic compounds, 276.
Cotarnine, condensation products of, 265.
Coumaranone derivatives, 101.
Coumaranonecarboxylic acid, ethyl ester, salts of, and hydrazone, 101.
Coumarin derivatives, new, 245.
Coumarin, nitro-6-amino-, and its acetyl derivative, 245.
Coumarin-6 diazo-5-oxide, 246.
Council, announcement of proposed changes in officers and, 38.
report of, 77.
Crotonaldehyde, condensation of, 208.
Crystals, dehydration of, 237.
Cupreine, absorption spectrum of, 325.

Damasceninic acid, synthesis of, 277.
Datura fastuosa, active constituents of, 248.
Datura Metel, active constituents of, 248
Datura Stramonium, active constituents of, 248.
Dehydro-β-naphthol sulphide, constitution of, 123.
Density of liquids, determination of, 100.
2 : 4- and 2 : 5-Diacetoxyanisole, 119.
4 : 4′-Diacetoxy- 3 : 3′-ditolyl, 5 : 5′-*di*bromo-, 227.
O-*N*-Diacetylsalicylamide, 102.
Diacetyltartaric acid, conductivity and dissociation of, 316.
2 : 2′-Dialdehydodiphenyl, and its hydrazone, 93.
Dialkylmalonylbenzidines, 73.
3 : 5 - Dibenzo - $\Delta^{3:5}$ - *cyclo*heptadiene, 1-imino-2-cyano-, 263.
3:5-Dibenzo-$\Delta^{3:5}$-*cyclo*heptadiene 2-carboxylic acid, 1-imino-, 263.
3 : 5-Dibenzo-$\Delta^{3:5}$-*cyclo*heptadien-1-one, 263.
Dibenzoyldianilinostilbene, 218.
4 : 4′-Dibenzoyloxy-3 : 3′-ditolyl, 5 : 5′-*di*bromo-, 227.
Dibenzylaminosuccinic acid, and its benzylamine salts, 206.
Dibenzylammonium nitrite, 127.
αα-Dibenzyl-β-methylpropane-αβ-diol, 142.
Dibenzylmethylsilicol, 9.
Dibenzyl*iso*propenylcarbinol, 142.
Dicinnamoylcarbamide, 72.
Diethylenesulphidemethylsulphine hydroxide, decomposition of, 140.
1 : 3-Diethyl*cyclo*hexadiene, from phenol, 276.
1 : 3-Diethyl*cyclo*hexan-5-ol, 277.
1 : 3-Diethyl-Δ^4-*cyclo*hexene and its *di*bromide, 277.
Diethyl*iso*propenylcarbinol, 141.
Diheptadecylcarbinol, and its acetate, 279.
Dihydrindamine, *di*hydroxy-, and its resolution, 259.
Dihydroanthracene, *tri*hydroxy-, 90.
Dihydrocarvone, cyano-, a new stereoisomeride of, 240.
Dihydrocinnamenylcarbimide (*β-phenylethyl* isocyanate), 206.
Diketohydrindamine, condensation of aldehydes and, 210.
Diketohydrindylidenediketohydrindamine, ammonium salt, 210.
Diketohydrindylideneuramil, potassium salt, 210.
1:3-Diketo-2-*o*-veratrylidenehydrindene, 58
4 : 5-Dimethoxy-2-*o*-anisylidene-1-hydrindone, 58.
2 : 3-Dimethoxycinnamic acid, 58.
4 : 5-Dimethoxy-1-hydrindone, and 2-*iso*nitroso-, 58.
4 : 6-Dimethoxy-2-β-methylaminoethylbenzaldehyde, synthesis of 191.
2 : 3-Dimethoxy-β-phenylpropionic acid, 58.
5 : 6-Dimethoxy - 2 - *o* - veratrylidene- 1 - hydrindone, 58.
5 - Dimethylaminoanilo - 3 : 4-diphenyl-*cyclo*pentene-1 : 2-dione and its derivatives, 309.

Dimethylammonium nitrite, 72, 122.
4 : 8-Dimethyl-6-*tert.*-butylcoumarin, 246.
Dimethyl-*p*-toluidine, absorption spectra of the nitration products of, 233.
αα-Dinaphthyl-β-methylpropane-αβ-diol, 142.
Dipentacosylcarbinol and its acetate, 279.
Dipentene nitrosoazide, 195.
Dipeptides, synthesis of, 55.
Diphenoquinone, new derivatives of, 226.
Diphenyl, 2 : 2′-*di*bromo- and 2 : 2′-*di*chloro-, 217.
*octa*hydroxy-, and its acetyl derivative, 195.
Diphenylcarbamyloximes of benzaldehyde and the nitrobenzaldehydes, 239.
Diphenyldiethylsilicoethylene, 144.
as-Diphenyldimethylethylene oxide, 142.
Diphenylene, 90.
Diphenylmethane *o*-sulphoxide, intramolecular rearrangements of, 3.
αα-Diphenyl-β-methylpropane-αβ-diol, 141.
Diphenyl*cyclo*pentenone, 309.
Dissociation pressures of hydrated salts, determination of, 45.
of the alkali hydrogen carbonates, 147.
Distillation, fractional, apparatus for, 64.
Disulphides, aromatic, interaction of sulphuric acid and, 65.
Disulphoxides, aromatic, interaction of sulphuric acid and, 139.
Ditoluquinone, stereoisomeric forms of, and its derivatives, 226.
2 : 2′-Ditolyl, formation of six- and seven-membered rings from derivatives of, 262.
2 : 2′-Ditolyl, ωω-*di*bromo- and ωω′ω′-*tetra*bromo-, 93.
3 : 3′-Ditolyl, 3-bromo-3′-nitro-4 : 4-*di*hydroxy-, and 5 : 5′-*di*nitro-4 : 4′-dihydroxy-, 227.
2 : 2′-Ditolyl-ωω′-dicarboxylic acid, and its diamide, 93.
2 : 2′-Ditolyl-ωω′-dicarboxylonitrile, 93, 263.
3 : 3′-Ditolyldisulphonic acid, 4 : 4′-*di*hydroxy-, barium salt, 227.
Dyeing, theory of, 244.

Elaidone and its oxime, 279.
Election of fellows, 39, 117, 186, 304.
Electrochemistry :—
Electrochemistry of solutions in acetone, 266.
Cells, concentration, with electrodes reversible to chlorine ions, 194.
Electrochemistry :—
Electrode, an ammonium, 242.
standard, with alkaline electrolyte, 70.
Electrolytes, solubility of, in aqueous solutions, 125, 328.
Electrolytic dissociation, relationship of molecular association to, 40.
Electrolytic reduction, 138, 310.
Electromotive forces in alcohol, 244.
Element Cu | Cu_2O alkali | H_2 at 0°, 69.
Epicamphor, and its oxime and semicarbazone, 166.
Equilibria, reversible membrane, 209.
$2CO \rightleftharpoons CO_2 + C$, effect of temperature and of pressure on, 126.
the methane, 305.
in the system : ethyl alcohol, acetic acid, ethyl acetate and water, 143.
See also Phase rule.
Ergothioneine, constitution of, 305.
Esterification, direct, of saturated and unsaturated acids, 314.
Ether. See Ethyl ether.
Ethers, phenolic, additive compounds of aromatic polynitro-derivatives with, 5.
Ethoxides, action of hydrogen sulphide on, 60.
ω-Ethoxymethylfurfuraldehyde, and its phenyl- and *p*-bromophenyl-hydrazone, 134.
ω-Ethoxymethylpyromucic acid, 134.
Ethyl alcohol, influence of temperatur on the basic water value of, 100.
influence of water on the boiling point of, 65.
hydrogen electrode in, 244.
electromotive forces in, 194.
hydrochloride, heat of hydrolysis of, 143.
Ethyl ether, estimation of traces of water in, 142.
Ethylammonium nitrite, 72, 122.
Ethylenebis-5-propylbarbituric acid, 73.
4(or 5)-Ethylglyoxaline, β-amino-, formation of, from histidine, 45.
new synthesis of, 91.
3-Ethylindole, β-amino-, synthesis of, and its derivatives, 20.
Explosions, dust, lecture experiment to illustrate, 161.

Faraday lecture, 177.
medal, presentation of, to Prof. T. W. Richards, 180.
Fermentation. See Autofermentation.
Ferrocyanides, isomerism of, 24.
organic, constitution of, 211.
Fisetol triethyl ether, 2-hydroxy-, 225.
Fluorone derivatives, 52.

Formic acid, interaction of cellulose and, 149.
Funnel, Buchner, addition to the, 189.

Galactose-*o*-carboxyanilide, 9.
Gallic acid trimethyl ether, action of nitric acid on, 213.
Gallotannic acid, acid character of, 213.
Garlic. See *Allium sativum*.
Gases, liquefied, properties of some binary mixtures of, 141.
Gelsemine, derivatives of, 157.
apo- and *iso-apo*-Gelsemine, 157.
d-Glucosamine, derivatives of, 23.
Glucosealanide, 9.
Glutaconic acid, identity of the α- and γ-positions in the molecule of, 122.
Glutaconic acids, chemistry of the, 252.
Glutaric acid, ββ-disubstituted, formation of, 42.
Glycine, interaction of alloxan and, 2.
Glycollaldehyde, bimolecular, 224.
Glyoxalines, formation of, 209.
4(or 5)-Glyoxalinemethylchloromalonic acid, ethyl ester and its sesquioxalate, 92.
β-Glyoxaline-4(or 5)-propionic acid, γ-α-amino- and γ-ᾱ-chloro-, 92.
Gnoscopine (dl-*narcotine*), synthesis and resolution of, 101.
Gold alloys with palladium, occlusion of hydrogen by, 56.
Grignard reagents, different methods of applying the, 39.

Halogen double salts, solution of, in water and ether, 328.
Halogens, absorption of, by dry slaked lime, 308.
reactivity of, in organic compounds, 119.
Halogen-containing compounds, molecular complexity of, 40.
Heptadecyl-α-naphthylamine, 104.
*cyclo*Hexanone-4-carboxylic acid, oxime of, molecular configuration of, 285.
Hexaphenylsilicoethane, 144.
Histidine, synthesis of, 206.
formation of 4(or 5)-β-aminoethylglyoxaline from, 45.
γ-Histidine, synthesis of, 92.
Hoff, Prof. J. H. van't, reference to decease of, 63.
Homologous series, normal, molecular rotatory power in, 311, 312.
Hydrates, determination of the vapour pressures of, 12.
Hydrazides, decomposition of, by heat, 193.
Hydrazobenzene, 4 : 4′-*di*nitro-, and 4-nitroso-4′-nitro-, 228.
Hydrazones, decomposition of, by heat, 193.
2-Hydrindamine, 1-hydroxy-, 259.
Hydrindantin, 97.
and its analogues, 163.
β-Hydrindone, preparation of, and its semicarbazone, 128.
Hydroaromatic series, alcohols of the, 324.
Hydrocarbons, synthesis of, at high temperatures, 217.
paraffin, lower limit of inflammation of mixtures of air and, 262.
Hydrogen, occlusion of, by the palladium-gold-alloys, 56.
Hydrogen chloride (*hydrochloric acid*), temperature-coefficient of the electrical conductivity of, in alcoholic solution, 247.
sulphide, action of, on the alkyloxides of the metals, 60.
Hydroxy-acids and -esters, action of phosphorus pentachloride and of thionyl chloride on, 232.
Hydroxy-compounds, aromatic, substitution in, 213.
o-Hydroxy-sulphoxides, aromatic interaction of sulphuric acid and, 123.
Hypaphorine, identity of, with the betaine of tryptophan, 258.
Hypnotic action and chemical constitution, 72.

Iminazolols, 158.
Iminazolones, 158.
Imino-compounds, formation and reactions of, 42, 219.
Indicators of the methyl-red type, 206.
International association of chemical societies, statutes of, 132.
Iodic acid, velocity of the reaction between sulphurous acid and, 320.
Iodo-compounds, organic, relative activities of certain, 283.
Ionisation in non-aqueous solvents, 208.
Ipomœa orizabensis, chemical examination of the root of, 304.
Iron, passivity of, 222.
porosity of, 311.
action of steam on, at high temperatures, 124.
action of salt solutions and of sea-water on, 156.
Isomerism between naphthiminazoles, 98.
position, relation of optical activity to, 123.

Jalapin, 305.

α-Keto-β-anilino-αβ-diphenylethane and its acyl derivatives, formation of glyoxalines from, 209.

γ-Keto-4(or 5)-butylglyoxaline and its oxime, 275.
Ketones, reactivity of towards iodine, 223.
hydroaromatic, 137.
of higher fatty acids, preparation of, 279.
Kino, gum, reactions of, 194.

Ladenburg, Prof. A., reference to decease of, 227.
Lauronic acid, amino-, derivatives of, 154.
Lauryl chloride, α-bromo-, 55.
Laurylglycine, α-amino- and α-bromo-, 55.
Lead, action of garlic-juice on, 234.
Leucyl-α-amino-*n*-nonoylglycine, 214.
d- and *l*-Limonene nitrosoazides, 195.
Liquids, determination of density of, 100.
mixed, latent heats of vaporisation of, 215, 319.
Lithium periodate, 198.

Magnesium cæsium chromate, 198.
rubidium chromate, 198.
Maleic acid, *di*bromo-, dibenzylamine salt, 206.
l-Malic acid, influence of inactive electrolytes on the optical activity of, in aqueous solution, 225.
Malonamides, condensation of malonic esters and, 72.
Malonic acid, esters of, condensation of malonamides and, 72.
ethyl ester, sodium salt, condensation of ethyl citraconate with, 281.
Malonylmalonamide, 73.
Maltose-*o*-carboxyanilide, 9.
Manganese:—
Permanganates, absorption spectra of, 66.
Mannitoboric acid, 136.
Mannose-*o*-carboxyanilide, 9.
Manometer, glass, some forms of, 45.
Matches, characteristics and chemical composition of some early, 229.
Mellissone and its oxime, 279.
Menthadiene, synthesis of a, from thymol, 276.
Menthadienes, synthesis of, 4, 57.
o-Menthenol(8), synthesis of the various forms of, 95.
Δ^2-*m*-Menthenol(8), *dl*- and *d*-, 4.
Δ^3-*m*-Menthenol(8), synthesis of *d*- and *l*-modifications of, 57.
d-Δ^3-*p*-Menthenol(8), synthesis of, 57.
Menthols corresponding with optically inactive menthone, 324.
Mercury, reducing actions of, 128.
action of garlic-juice on, 234.
influence of ferric salts and of manganese nitrate on the rate of solution of, in nitric acid, 4.
alloys with silver and tin, 5.
Metallic ions, relation between the absorption spectra of, and their valency, 68, 328.
oxides, interaction of phosphoryl chloride and, 155.
Metals, aerial oxidation (rusting), of 221.
passivity of, 222.
Methane equilibrium, 305.
Methane, nitro-, condensation of aromatic aldehydes with, 20.
condensation of camphorquinone with, 327.
Methoxyberberinium iodide, 215.
5-Methoxycinnamic acid, 2 : 4-*di*hydroxy-, 119.
ω-Methoxymethylfurfuraldehyde, 134.
ω-Methoxymethylpyromucic acid, 134.
Methoxy*peri*naphth-hydrindone, 258.
β - 2 - Methoxynaphthylacrylic acid, 258.
β - 2 - Methoxynaphthylpropionic acid, 258.
4-Methoxy-α-phenylethanol, β-3 : 5-*tri*nitro-, 21.
α-*m*-Methoxyphenylethylamine, *p*-hydroxy-, and its hydrochloride and benzoyl derivative, 42.
5-Methoxy-β-phenylpropionic acid, 2 : 4-*di*hydroxy-, and its lactone, 119.
6-Methoxyquinoline, absorption spectrum of, 325.
p-Methoxysalicylaldehyde and its occurrence in the root of a species of *Chlorocodon*, 235.
p-Methoxysalicylideneaniline, 235.
4-Methoxystyrene, ω-3-*di*nitro-, 21.
1-Methyl-4- and -5-β-aminoethylglyoxaline, 275.
4(or 5) Methyl-5(or 4)-β-aminoethylglyoxaline, 259.
2-Methylamino-3-methoxybenzoic acid, synthesis of, 277.
4(or 5)-Methyl-5(or 4)-aminomethylglyoxaline, 259.
Methylammonium nitrite, 22.
γ-Methylbutane-αβδ-tricarboxylic acid, synthesis of, 95.
4(or 5)-Methyl-5(or 4)-chloromethylglyoxaline, 259.
6-Methylcoumarin, and nitro-, 246.
1-Methyl-4- and -5-cyanomethylglyoxaline, 275.
4(or 5)-Methyl-5(or 4)-cyanomethylglyoxaline, 259.
β-Methyl-$\Delta^{\alpha\gamma}$-decadiene, 12.

2-Methyldiphenyl-2′-carboxylic acid, ω-hydroxy-, and its lactone, 262.
β-Methyl-$\Delta^{\alpha\lambda}$-dodecadiene, 12.
5-Methylenеamino-4:5:4′:5′-tetrahydro-4:4′-dipyrimidyl, 2:4:6:2′:4′:5′:6′-*hepta*hydroxy-, 2.
Methylenecamphor, nitro-, 327.
β-Methyl-γ-ethylpentane-βγ-diol, 141.
as-Methylethylsuccinic acid, resolution of, 46.
Methylfurfuraldehyde, ω-bromo-, some reactions of, 134.
Methylglucosamine, and its hydrochloride, 23.
4(or 5)-Methylglyoxaline, chloro-, cyano-, and hydroxy-, 91.
dl-1-Methyl-Δ^3-*cyclo*hexene-3-carboxylic acid, resolution of, 57.
d-1-Methyl-Δ^3-*cyclo*hexene-4-carboxylic acid, preparation of, 57.
1-Methyl*cyclo*hexenecarboxylic acids, ethyl esters, 95.
1-Methyl*cyclo*hexylidene-4-acetic acid, molecular configuration of, 285.
optically active derivatives of, 212.
Methylhydroxycamphor, nitro-, 327.
4(or 5)-Methyl-5(or 4)-hydroxymethylglyoxaline, 259.
l-Methylinositol, occurrence of, in Pára rubber, 54.
4(or 5)-Methyl-5(or 4)-methylaminomethylglyoxaline, 259.
Methyl-*n*-pentadecylcarbinol and its derivatives, 313.
Methyl *n*-pentadecyl ketone and its semicarbazone, 313.
β-Methyl-γ-propylhexane-βγ-diol, 141.
Methyl-red, potassium salt, 206.
Methyl-*n*-tridecylcarbinol and its derivatives, 312.
Methyl *n*-tridecyl ketone, 312.
Mixtures, binary, of some liquefied gases, properties of, 141.
Molecular association and its relationship to electrolytic dissociation, 40.
in water, 8.
complexity of halogen-containing compounds, 40.
Montanone and its derivatives, 279.
Myrica Gale, composition of the essential oil of, 220.
Myricetin hexamethyl ether, 225.
Myristicinic acid, nitro-, orientation of the nitro-group in, 20.

Naphthalides, chlorination of, 196.
Naphthiminazoles, isomerism between, 98.
α-Naphthol, chlorination of, 266.
α-Naphthol, 2:4-*di*chloro-, and 4-chloro-2-bromo-, 267.
2-Naphthol-3:6-disulphonic acid, 1-nitroso-, monosodium salt, 141.
α-1-Naphthylaminostearic acid, 104.
Naphthylideneamines, 260.
dl-Narcotine. See Gnoscopine.
Nickel sodium oxalate, stability of, 260.
Nitrogen, relation residual affinity and chemical constitution in certain compounds of, 243.
nitric acid, action of nascent hydrogen on, 326.
decomposition of, by light, 306.
interaction of copper and, in presence of metallic nitrates, 42.
Nitrogen, estimation of, in organic compounds, 207, 309.
Nitrohydrazo-compounds, alkaline condensations of, 228.
Nitrosates, interaction of sodium azide and, 19.
n-Nonoic acid, α-amino-, synthesis of polypeptides of, 214.
n-Nonoyl chloride, α-bromo-, 214.
n-Nonoylglycine, α-amino- and α-bromo-, 214.

Oleone and its oxime, 279.
Optical activity. See under Photochemistry.
Organic compounds, refractive and dispersive power of, 315.
reactivity of the halogens in, 119.
estimation of carbon and nitrogen in, 207, 309.
Origanum hirtum, essential oil of, 284.
Oxalic acid, solubility of, in other acids, 328.
Oxidation of organic substances, catalysis in the, 24.
*iso*Oxyberberine and its acetyl and nitroso-derivatives, 59.
*neo*Oxyberberine, 215.
*neo*Oxyberberineacetone, 215.
Oxygen, volumetric estimation of, in air, 135.
Ozone, decomposition of dry, 224.

Palladium alloys with gold, occlusion of hydrogen by, 56.
Palmitic acid, the system: sodium palmitate and, 216.
Papaveraldine, identity of xanthaline and, 4.
Pára rubber, carbohydrate constituents of, 54.
Pentamethylquercetin, and its salts and derivatives, 164.
Pentamminenitrosocobalt salts, sensitiveness of, to light, 160.
Pentane-αβδ tricarboxylic acid, synthesis of, 95.

*cyclo*Pentanone-4-carboxylic acid, formation of, 281.
Permanganates. See under Manganese.
Petroleum, estimation of sulphur in, 329.
Petroleums, heavy, determination of the density of, 250.
Phase rule, simple demonstration of Gibbs's, 13.
Phenanthrene, synthesis of, 92.
Phenol derivatives, syntheses with, containing a mobile nitro-group, 157, 263.
Phenol, β-*p*-nitro-, colour change in, brought about by sunlight, 158.
Phenols, chlorination of, 139.
additive compounds of aromatic polynitro-derivatives with, 5.
Phenothioxin, synthesis of derivatives of, 44.
α-Phenylacetamide, α-amino-, and its derivatives, 22.
Phenylacetonitrile, condensation of camphorquinone with, 327.
Phenylalanine, *dl*-3 : 4-*di*hydroxy-, synthesis of, 56.
2-Phenyl-1 : 3-benzoxazine-4-one, action of ammonia and amines on, 190.
Phenyl bromo-*p*-methoxystyryl ketone, 198.
Phenylcyanomethylenecamphor, 327.
Phenyldiethylsilicol, 9.
Phenylethanol, β-nitro-2 : 5-*di*hydroxy-, 21.
α-Phenylethylamine, *p*-hydroxy-, resolution of, 42.
Phenylfluorone, 53.
Phenyl *p*-methoxystyryl ketone dibromide, elimination of bromine from, 197.
Phenylmethylethylsilicol, 9.
β-Phenyl-β-methylvaleric acid, 46.
Phenylnaphthafluorone, 53.
Phenyl *iso*propyl ketone, reactions of, 239.
Phenylsalicylacetamidine, 102.
Phenylstibinic acid, nitro-derivatives of, 274.
Phenyl styryl ketone, semicarbazones of, 316.
9-Phenylxanthonium, 3 : 6-*di*chloro-, chloride, 52.
Phosphorus :—
Phosphoric acid, condensation of acetone in presence of, 71.
dl-phenyl β-naphthyl hydrogen salt, resolution of the *l*-menthylamide, 66.
Phosphoric acids, the, 21.
Orthophosphoric acid, second and third dissociation constants of, 121.
Thiophosphoric acid, isomeric α- and β-methyl esters of, 72.
Phosphorus :—
Phosphoryl chloride, interaction of metallic oxides and, 155.
Photochemistry :—
Absorptive power, influence of conjugated linkings on, 46, 153.
Canal rays, chemical action induced by, 94.
Cathode rays, chemical action induced by, 94.
Optical activity, effect of contiguous unsaturated groups on, 6.
relation of position isomerism to, 123.
influence of double linking on, 319
Photochemical and thermal interaction of chlorine and carbon monoxide, 223.
Radiant energy, course of chemical change in quinol under the influence of, 137.
Rotation of the menthyl esters of the fluoro- and iodo-benzoic acids and of the halogen derivatives of the fatty acids, 123.
Rotatory power, dependence of, on chemical constitution, 324.
relative effects of ethylenic and acetylenic linkings on, 6.
molecular, in normal homologous series, 311, 312.
Spectra, absorption, of metallic ions, relation between, and their valency, 68, 328.
of some benzene derivatives, 46.
of chloro- and bromo-benzene, 71
of chlorobenzene, the dichlorobenzenes and the chlorotoluenes, 72.
of chlorine and bromine derivatives of benzene and toluene, 218.
of cinchonine, quinine, and their isomerides, 148.
of the isomeric hydrazones and semicarbazones of camphorquinone, 224.
of iodine derivatives of benzene and toluene, 280.
of the nitration products of dimethyl-*p*-toluidine, 233.
of permanganates, 66.
of quinine, cupreine, 6-methoxy- and 8-hydroxy-quinoline, 325.
of triketohydrindene hydrate and certain derivatives, 242.
Phototropy, studies in, 260.
Phthalylhydrazides, polymorphic, 193.
Physovenine, 273.
Picoline methonitrite, 208.
Picolinic acid, 3 : 5-*di*chloro-4-amino-, 3 : 5-*di*chloro-4-hydroxy-, and 4 : 5-*di*chloro-3-hydroxy-, 221.

Picolinium nitrite, 208.
Picraminobenzoic acids, and their salts, 22.
Picric acid, colour and molecular state of, 244.
Pinacones, synthesis of, 141.
Pinene nitrosoazide, and its isomeride and their derivatives, 19.
Pinus longifolia, constituents of the oil of, 247.
Piperidine, production of imino-derivatives of, 42.
methonitrite, 208.
Piperidinium nitrite, 208, 242.
Plants, Indian solanaceous, active constituents of, 248.
Potassium cupricarbonates, 55.
persulphate, interaction of silver nitrate and, 24.
Pressures, constant, apparatus for maintenance of, 64.
Propylammonium nitrite decomposition of, by heat, 291.
Proteins of muscle, reactions between chemical compounds and, 3.
Pyridine, compounds of copper benzoate with, 94.
chlorine derivatives of, 220.
methonitrite, 208
Pyridine, 3 : 5-*di*chloro-4-amino-, and *di*-chlorohydroxy-, 221.
Pyridinium nitrite, 71.
Pyrogallolcarboxylic acid trimethyl ether, action of nitric acid on, 213.

Quercetin, amino-, and its salts and acetyl derivative, 164.
Quinaldine synthesis, mechanism of the, 43.
Quinine, absorption spectrum of, 148, 325.
Quinol, course of chemical change in, under the influence of radiant energy, 137.
copper derivative of, 155.
Quinol, 3 : 5-*di*nitro-, salts of, 14, 98.
Quinoline, compounds of copper benzoate with, 94.
methonitrite, 208.
Quinoline, 6-hydroxy-, absorption spectrum of, 325.
*iso*Quinoline alkaloids, synthetical experiments in the group of, 125, 265.
derivatives, 215.
Quinolinium nitrite, 208.
Quinone-imides, 157, 263.

Radium, action of, on ammonia, 7.
Reduction, electrolytic, 138, 310.
Resorcinol, 4 : 6-*di*nitro-, salts of, 14.
Rhamnose-*o*-carboxyanilide, 9.
Rheinolic acid, 89.
Rhubarb, constituents of, 89.
occurrence of alizarin in, 101.
Rubidium magnesium chromate, 198.

Salicylamide, condensation of acetyl chloride and, 102.
Salts, hydrated, constancy of water of crystallisation in, 17.
determination of the dissociation pressures of, 45.
Scopoletin, constitution of, 119.
Semicarbazones, 315.
Silicoethane, derivatives of, 143.
Silicoethylene, derivatives of, 143.
Silicols, preparation of tertiary, 8.
Silicon organic compounds, 8.
Silver alloys with mercury, 5.
nitrate, interaction of potassium persulphate and, 24.
Soaps, constitution of, in solution, 5.
Sodium hydrogen carbonate, dissociation pressure of, 147.
hypophosphite, action of, on copper sulphate, 139.
cobalt oxalate, stability of, 260.
nickel oxalate, stability of, 260.
Solids, finely divided combustible, surface areas of, 161.
Solubility, contribution to the thermodynamic theory of, 221.
of salts in the corresponding acids 125.
coefficients, determination of, 21.
Solute, volume of a, in solution, 96.
Solutions, application of Kirchhoff's equation to, 221.
electrochemistry of, in acetone, 266.
Solvents, non-aqueous, ionisation in, 208.
Somnirol, 53.
Somnitol, 53.
Spring, Prof. W., reference to decease of, 227.
Stearic acid, sodium salt, electrical conductivity of solutions of, 5.
Stereoisomerism, a new variety of, 226.
Stilbenediol diacetates, nitration of, 44.
Styrene, derivatives of, 21.
Styrene-3-carboxylic acid, ω-nitro-2-hydroxy-, 21.
m- and *p*-Styryloxyacetic acid, ω-nitro-, ethyl esters, 21.
Sublimation, apparatus for, in a vacuum, 236.
Substance, $C_9H_{16}O_2$ from camphene, and its derivatives, 212.
$C_{11}H_{10}O_4$, from ω-bromomethylfurfuraldehyde, 134.

Succinic acid, *s*-*di*bromo-, action of aliphatic amines on, 320.
action of benzylamine on, 206.
Succinic acids, *di*bromo-, configuration of the stereoisomeric, 150.
Sucrose, density of liquid, and of its solutions in water, 208.
Sugars, *o*-carboxyanilides of the, 9.
Sulphinic acids, aromatic, intermolecular condensation of, 139.
SULPHUR :—
Sulphuric acid, interaction of aromatic disulphides and, 65.
Sulphurous acid, velocity of the reaction between iodic acid and, 320.
Pentathionic acid, occurrence of, in natural waters, 10.
Sulphur, estimation of, in petroleum, 329.

i-Tartaric acid, dibenzylamide of, 207.
Tautomeric change, relative rates of, 223.
Tautomerism, experiments on, 122.
Tellurium, atomic weight of, 18.
alleged complexity of, 187.
Terpene series, alcohols of the, 324.
Terpenes, contributions to the chemistry of the, 211, 248, 276.
synthesis of, 57, 95.
Terpineol nitrosoazide, 20.
Tetramethylammonium nitrite, decomposition of, by heat, 4.
hyponitrite, decomposition of, by heat, 120.
3 : 4 : 3′ : 4′ - Tetramethyldiphenyl, 6 - nitro-, 90.
Tetramethylglucose - β - naphthylamide, -*p*-phenetidide and -*p*-toluidide, 9.
1 : 2 : 4 : 5 - Tetraphenylglyoxaline and its salts, 209.
THERMOCHEMISTRY :—
Latent heats of vaporisation of mixed liquids, 215.
Thermotropy studies in, 260.
Thiobenzanilide, preparation of, 8.
oxide, 120.
"Thioindigo," synthesis of, 317.
2-Thiol-(4 or 5)-aminomethylglyoxaline, 91.
Thio-oxalic acid, complex salts of, 279.
Thiophosphoric acid. See under Phosphorus.
Thioxanthone, synthesis of derivatives of, 207, 265.
Thioxanthone, 1 : 4-*di*hydroxy-, 212.
Thyme, Dalmatian white, essential oil of, 285.
Thymomenthol, oxalate of, 276.
Tin alloys with mercury, 5.
Tin ores, decomposition of refractory, 60.
Toluene, absorption spectra of derivatives of, 218.
chloro-derivatives, absorption spectra of, 72.
iodo-derivatives, absorption spectra of, 280.
as-Toluene-*p*-sulphonylmethyl-*m*- and -*p*-phenylenediamines, 326.
Toluene *p* - sulphonyl-1 : 6 - *di*nitro- β - naphthylamine, 326.
m-Toluic acid, 5-bromo-6-hydroxy-, 227.
o- and *p*-Toluidine antimony trichlorides, 125.
Triacetylglucosamine, bromo-, hydrobromide, 23.
Triacetylmethylglucosamine, hydrobromide, 23.
Trianiline antimony pentachloride, 125.
i-, *d*-, and *l*-Triazodihydrocarvones and their semicarbazones, 195.
β-Triazoethylamine and its salts and derivatives, 154.
Triazo-group, the, 19, 154, 195.
β-Triazomethylbutane-γ-one, and its derivatives, 19.
Tribenzylsilicol, 9.
Tricarballylic acid, formation of, 219.
Triethylammonium nitrite, 71, 242.
action of heat on, 264.
Triketohydrindene hydrate, 97, 163, 210.
and its derivatives, absorption spectra of, 242.
Trimercuridiethylammonium nitrite, 220.
2 : 4 : 5-Trimethoxycinnamic acid, 119.
2 : 4 : 5-Trimethoxy - β - phenylpropionic acid, and its methyl ester, 120.
Trimethylamine, compound of cuprous thiocyanate and, 140.
α - Trimethylamino - β - indolepropionic acid, methyl ether, quaternary iodide of, 258.
Trimethylammonium nitrite, 72, 122.
1 : 1 : 2-Trimethylcyclohexan-3-one, 137.
1 : 4 : 5-Triphenylglyoxaline and its salts, 209.
1 : 4 : 5-Triphenyl-2-methylglyoxaline and its salts, 209.
Triphenylsilicol, 9.
Triphenylstibine, *tri*-*m*-amino-, 274.
Troost, Pr f. L. J., reference to decease of, 227.
Tryptophan, identity of betaine of, with hypaphorine, 258.

Unsaturated compounds containing the ethenoid and ethinoid linking, viscosity of, 93.

*iso*Valeryl-*p*-aminoacetophenone, α-bromo-, 72.
Vapour pressures of hydrates, determination of, 12.
o-Veratraldehyde, derivatives of, 57.
o-Veratric acid, 57.
1-Vinyl-β-naphthol, ω-nitro-, 21.
Viscometry, application of, to the measurement of rate of reaction, 59.
Viscosity, correlation of, with other physical properties, 93.
Volumes, molecular, influence of the alternating factor in certain series on the, at the melting point, 196.

Walden inversion, experiments on the, 232.
Water, molecular association in, 8.
of crystallisation, constancy of, in hydrated salts, 17.
Natural waters, occurrence of pentathionic acid in, 10.
Withania somnifera, constituents of, 53.
Withanic acid and its methyl ester, 53.
Withaniol, 53.

Xanthaline, identity of papaveraldine and, 4.
o-Xylene, derivatives of, 307.
o-Xylene, 3-nitro-, and 3:6-*di*nitro-, 307.
o-Xylidines, *di*nitro-, 307.

Yeast, influence of salts on the autofermentation of, 103.

R. CLAY AND SONS, LTD., BRUNSWICK STREET, STAMFORD STREET, S.E., AND BUNGAY, SUFFOLK.

Issued 30/1/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 380.

Thursday, January 19th, 1911, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. Henry Dent Gardner, jun., and Thomas R. Merton were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

John Ewart Trounce Barbary, Vellansaundry, near Camborne.
Harold Christopher, B.Sc., Mona, Lucien Road, Tooting Common, S.W.
Harold Edgar Dryden, 490, Stanton Road, Burton-on-Trent.
James Furnival Eardley, Elmsdale, Broomhall Park, Sheffield.
William Joseph Chetwynd Horne, c/o Messrs. Cleeve Bros., Lansdowne, Limerick.
Reginald Hurst, 50, Culverley Road, Catford, S.E.
James William MacBain, M.A., Ph.D., 71, Cotham Brow, Bristol.
Edward Partington, Oakdene, Sedgley Park, Manchester.
Cyril James Peddle, M.Sc., 146, Barnsley Road, Cudworth, near Barnsley.
David Thomson, M.A., B.Sc., Ph.D., Viewpark, Litham Road, Strathaven, N.B.
William Denham Verschoyle, 15, Winch Building, Vancouver, B.C.
Bertie James Waygood, 39, Marshall Road, Levenshulme, Manchester.

Edward Escott Wood, Hurricane House, Brymbo, N. Wales.
Charles Fursdon Yates, Ronaldene, Witham Road, Isleworth.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

Solomon Farley Acree, Johns Hopkins University, Baltimore, Md., U.S.A.
Robert Leonard Emerson, A.B., M.D., Boston, Mass., U.S.A.

Of the following papers, those marked * were read:

***1. "The interaction of alloxan and glycine."**
By William Holdsworth Hurtley and William Ord Wootton.

The authors have examined the action of alloxan on glycine in aqueous solution. By mixing concentrated solutions of these, Piloty and Finkh (*Annalen*, 1904, **333**, 22) isolated a substance which they described as glycine purpurate. The authors regard this product as a mixture of at least three substances. They have examined the action as it occurs in dilute solution on heating, and, unlike Strecker (*Annalen*, 1862, **123**, 363) and Piloty and Finkh (*loc. cit.*), find that formaldehyde is evolved. The reaction occurs in several stages, murexide being produced first, then a substance closely related to uramil, and finally a substance isolated by Piloty and Finkh and regarded by them as uramidoacetic acid. This, the main product of the reaction, is a pale yellow, crystalline solid, characterised by powerful reducing properties, by yielding formaldehyde on hydrolysis or by treatment with 50 per cent. nitric acid, by the production of an amide with ammonia, and by the formation of alloxan with dilute nitric acid. The authors are of the opinion that a substance possessing these properties cannot have the formula:

$$CO\begin{<}{NH\cdot CO \atop NH\cdot CO}\end{>}CH\cdot NH\cdot CH_2\cdot CO_2H,$$

which is assigned to it by Piloty and Finkh; they give it therefore the following constitution, which is more closely in accord with its reactions:

$$\begin{matrix}CO\cdot CH(N{:}CH_2)\\ NH{-}CO{-}NH\end{matrix}\!\!>\!C(OH)\cdot C(OH)\!<\!\begin{matrix}CH(OH)\cdot CO\\ NH{-}CO{-}NH\end{matrix} \quad \text{or}$$

$$\begin{matrix}C(OH)\cdot CH(N{:}CH_2)\\ \|\qquad\qquad\|\\ N\cdot C(OH)=\!=\!=N\end{matrix}\!\!>\!C(OH)\cdot C(OH)\!<\!\begin{matrix}CH(OH)-C\cdot OH\\ \qquad\qquad\|\\ N{:}C(OH)\cdot N\end{matrix},$$

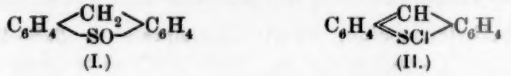
and propose to name it 2 : 4 : 6 : 2′ : 4′ : 5′ : 6′-*heptahydroxy*-5-*methyleneamino*-4 : 5 : 4′ : 5′-*tetrahydro*-4 : 4′-*dipyrimidyl*.

Discussion.

Dr. Hurtley, in reply to Dr. Pyman, stated that the yield of formaldehyde in this reaction was 7·5 per cent. of the theoretical.

***2. "Intramolecular rearrangements of diphenylmethane *o*-sulphoxide." By Thomas Percy Hilditch and Samuel Smiles.**

Diphenylmethane *o*-sulphoxide (I) is obtained by the oxidation of thioxanthen with hydrogen dioxide, and it is converted into the red carbothionium chloride (II) by the action of hydrogen chloride



(I.) (II.)

in dry alcohol. This salt is more readily obtained from thioxanthenol with hydrogen chloride in ethereal solution, and, if excess of hydrochloric acid is removed, it is transformed into thioxanthenyl chloride, $C_6H_4<^{CHCl}_{S}>C_6H_4$. Thioxanthenol is regenerated from the latter substance or from the carbothionium salt by the action of water or alkaline reagents. The transference of oxygen from sulphur to carbon, which may be effected by thus converting the sulphoxide into thioxanthenol, may be carried out by the aid of heat alone, for both substances furnish thioxanthenyl oxide when they are heated to about 120°.

This rearrangement was discussed from a general point of view, and in its bearing on the behaviour of the analogous diphenylamine *o*-sulphoxide.

***3. "The reactions between chemical compounds and living muscle-proteins." By Victor Herbert Veley.**

The main conclusions drawn by the author are as follows:

(1) When a living muscle is immersed in solutions of certain compounds, a chemical change takes place between the solute and the amino-acids formed from the muscle-proteins by hydrolysis; its rate can be measured by the height of response to induction shocks used as an indicating record.

(2) In most cases examined, the rate of change is a logarithmic function of time represented by the equation of a reaction of the first order, namely, $K=1/t(\log r_0/r_t)$, in which r_0 is the number of units of potential chemical change, when $t=0$, and r_t the number of units remaining after expiry of time t.

In a few cases the rate of change is a linear function of time,

which, although less conclusive, does not exclude the possibility of a chemical change.

If the hypothesis be correct that the chemical changes are due to a reaction between the drug, whether acid or base, and the amino-acid, either formed by hydrolysis of the muscle-proteins or present by virtue of the moribund condition of the muscle, then amino-acids should produce no change, or, in other words, the record would not differ from that of a fatigue effect. Results were given in the case of aminoacetic acid in proof of this line of argument.

4. "The decomposition of tetramethylammonium nitrite by heat." By Prafulla Chandra Rây and Hemendra Kumar Sen.

Tetramethylammonium nitrite decomposes at 228—230°, but more regularly and rapidly at 250—260°. The main gaseous products of decomposition are trimethylamine, methyl nitrite, carbon dioxide, nitric oxide, nitrogen, and water. A small fraction of the salt at the same time undergoes charring with the formation of an oily liquid which soon becomes resinified.

5. "Influence of minute quantities of ferric salts and of manganese nitrate on the rate of solution of mercury in nitric acid." By Prafulla Chandra Rây.

Minute quantities of ferric nitrate (0·026 gram) or ferric sulphate (0·0025 gram) in dilute nitric acid (50 c.c.) containing 12 to 13 per cent. of the acid have a marked retarding effect on the dissolution of mercury in it.

Manganese and sodium nitrates, on the other hand, accelerate the dissolution of mercury in nitric acid.

6. "On *dl*- and *d*-Δ^2-*m*-menthenol(8) and *dl*- and *d*-$\Delta^{2:8:(9)}$-*m*-menthadiene." By Walter Norman Haworth, William Henry Perkin, jun., and Otto Wallach.

An account was given of the synthesis of the substances mentioned in the title and of many of their derivatives, by two different methods. The physical properties of all these substances have been determined and were fully discussed.

7. "The identity of xanthaline and papaveraldine." By Bessie Dobson and William Henry Perkin, jun.

The authors have made a careful study of the alkaloid xanthaline, which Messrs. T. and H. Smith (*Pharm. J.*, 1893, p. 793) isolated in very small quantities from opium, and they find that this alkaloid is identical with papaveraldine.

8. "Amalgams containing silver and tin." By Reginald Arthur Joyner.

The non-existence of any compound of silver with tin other than Ag_3Sn is confirmed. The "ageing" of filings of silver-tin alloy has been experimentally verified and investigated. The composition of saturated liquid amalgams of tin, of silver, and of tin with silver has been determined at a number of temperatures, and the equilibrium diagram representing the ternary systems existing below 63° has been ascertained. No ternary compound exists at these temperatures, and the stable solid phases are the compound Ag_3Hg_4 and a solid solution containing a small amount of mercury dissolved in tin. No solid solution exists between these two solid phases. The alloys of silver with tin are thus completely decomposed by the action of excess of mercury. At higher temperatures a ternary compound is formed.

9. "Studies of the constitution of soaps in solution. The electrical conductivity of sodium stearate solutions." By Richard Charles Bowden.

At 90° the equivalent conductivity of sodium stearate in aqueous solution is about half that of sodium acetate, being 88·3 mhos in a weight-normal solution, about 77 for solutions between $N/2$- and $N/20$-, but rising to 125·9 in $N/100$-solution. It is considered that these measurements demonstrate the presence of a high concentration of free electrolyte in solutions of sodium stearate. The change in conductivity with the dilution differs from that in solutions of sodium palmitate, but it is not less remarkable. Attention was drawn to the connexion between these phenomena and the analogous behaviour of certain non-aqueous solutions as well as to the salting out from soap solutions of acid sodium salt by means of concentrated solutions of sodium hydroxide.

10. "Additive compounds of phenols and phenolic ethers with aromatic polynitro-derivatives." By John Joseph Sudborough and Stanley Hoskings Beard.

The authors described a number of additive compounds prepared from *s*-trinitrobenzene and phenols, phenolic ethers, and cyclic oxygen derivatives. Many of the compounds are coloured, but as a rule are much paler than the additive compounds of amines and *s*-trinitrobenzene.

11. "The effect of contiguous unsaturated groups on optical activity. Part VI. The influence of the carbonyl group on optical rotatory power. Part VII. The relative influences of aromatic and hydroaromatic nuclei on optical rotatory power. Part VIII. The influence on optical activity of two contiguous unsaturated groups in comparison with that of one unsaturated group at varying distances from the optically active complex." By Thomas Percy Hilditch.

(1) The author has sought to obtain evidence of the effect of the system $\cdot CO \cdot CO_2H$ on optical rotatory power, in order to effect a comparison with that of the group $\cdot CH{:}CH \cdot CO_2H$, which is now fairly well known.

From investigation of the menthyl esters and brucine salts of ketonic acids of the pyruvic, mesoxalic, and phenylglyoxylic series, it appears that the carbonyl group increases the initial effect of the carboxyl group on the molecular rotatory power of the optically active alcohol or acid, and its influence is thus very similar to that of an ethenoid bond.

(2) The relative influences of aromatic and hydroaromatic nuclei on optical activity have been investigated by means of the salts formed from corresponding aromatic and hydroaromatic bases with optically active acids (camphoric, camphor-π-sulphonic, and tartaric acids). The results show consistently that so long as an aromatic group is contiguous to the basic nitrogen atom, a well-defined optical anomaly persists, but this disappears wherever the radicle attached to the nitrogen is fully reduced. It was also pointed out that "ring-formation," which is usually stated to produce a large alteration in rotatory power, does so only when the asymmetric carbon atoms form part of the ring system.

(3) Rupe (*Annalen*, 1903, **327**, 157) has stated that the nature of the effect of unsaturated groups on optical activity is determined by their nearness to the asymmetric atoms. Experiments have been carried out to decide whether, in certain cases, it is the proximity of an unsaturated system to the asymmetric complex, or the conjugated unsaturated groups present, which causes the anomaly in rotatory power, and it appears that whilst both causes undoubtedly operate, the latter is the more powerful factor.

12. "The relative effects of ethylenic and acetylenic linkings on optical rotatory power." By Thomas Percy Hilditch.

d-*Methylhexylcarbinyl β-phenylpropionate, cinnamate,* and *phenylpropionate,* and the neutral and acid *menthyl* esters of

succinic, *fumaric*, and *acetylenedicarboxylic acids* have been examined with respect to the relative effects of the ethylenic and acetylenic linkings on optical rotatory power; the former series is interesting in view of the simplicity of the asymmetric system in the alcohol used and the similarity of this compound to amyl alcohol.

From a general survey of the fourteen series of active salts or esters of these acids now available for comparison, it is seen that in twelve cases the fully saturated member is least anomalous in optical activity, whilst in the other two the ethylenic and acetylenic compounds respectively possess the smallest rotatory power. On the other hand, it is concluded that there is no general rule to cover the relative effects of the double and triple carbon linkings, and that the influence of the acetylenic (+carboxyl) residue is in general much less well defined than that of the ethenoid (+carboxyl) group.

13. "The direct action of radium on ammonia."
By Edgar Philip Perman.

The rate of decomposition of ammonia by the direct action of radium bromide has been measured approximately. The pressure of the ammonia, together with its decomposition products, decreased for five weeks, and then steadily increased. The reaction appears to be of the first order.

14. "Cupritartrates and analogous compounds."
By Spencer Umfreville Pickering.

By adding potassium hydroxide to copper tartrate just short of alkalinity, and precipitating by alcohols, a cupritartrate of the formula $(C_2H_4O_2{\cdot}CuO)_2(CO_2)_4K_2Cu,H_2O$ is obtained, and by the further action of the alkali and water, two others derived from this by the partial substitution of copper for the potassium were also prepared. Analogous compounds of saccharic and mucic acid were obtained, $(C_4H_8O_4{\cdot}CuO)_2(CO_2)_4K_2Cu,H_2O$, as also was an *a*-cupritartrate, $(C_2H_4O_2{\cdot}CuO)_4(CO_2)_8K_4Cu_2,(CuCO_3)_2,Na_2CO_3$. All six compounds, when dried at a temperature just below that at which they decompose, gave minimum molecular weights agreeing with these formulæ, and inconsistent with the view that the copper displaces the hydrogen in the alcoholic hydroxyl. Probably this hydrogen is displaced by the group $(Cu^{II}OH)^{I}$, the copper in the carboxylic portion of the molecule being present as $(Cu^{IV}O)^{II}$, as in the cupricitrates. Quinic acid forms analogous compounds, but these were not obtained in a pure condition.

15. "Molecular association in water."
By Cyril James Peddle and William Ernest Stephen Turner.

Following on the work of Meldrum and Turner, which revealed the existence of molecular association in water of a number of amides and anilides (*Trans.*, 1908, **93**, 876; 1910, **97**, 1805), it was shown that molecular association in water is of frequent occurrence. A number of carboxylic acids, phenols, and amines have now been examined. Except in the case of the aliphatic amines, most of the substances are distinctly associated. Benzoic acid is more associated in water than in benzene. The appearance of water among the solvents which permit association, so contrary to the general experience and belief in its dissociating power, was explained on the supposition that molecular association in water is really due to a dissociation of complex water molecules, a view suggested in connexion with the amides, and now further developed and applied to other associated solvents.

16. "Note on the preparation of thiobenzanilide."
By Edward de Barry Barnett.

Thiobenzanilide can readily be obtained in 90 per cent. yield by the following modification of Bernthsen's method (*Ber.*, 1878, **11**, 503). Twenty grams of benzanilide are intimately mixed with 10 grams of finely ground phosphorus pentasulphide and 10 grams of finely ground phosphorus trisulphide. The whole is then cautiously heated over a naked flame with continual shaking until fusion takes place. After cooling, the mass is extracted several times with boiling acetone or alcohol, the united extracts rendered strongly alkaline with sodium hydroxide, and then poured into a large bulk of water. The dark solution obtained on filtration is then saturated with carbon dioxide, when the thioanilide is obtained as a yellow, crystalline precipitate, which need not be further purified.

Attempts to apply the above method to the preparation of thioformanilide and thioacetanilide were not successful, owing to the large quantity of tarry matter formed.

17. "Organic derivatives of silicon. Part XIV. The preparation of tertiary silicols." By Frederic Stanley Kipping and John Edward Hackford.

Tertiary silicols, $R_3Si{\cdot}OH$, can be prepared by treating silicones, R_2SiO, with a Grignard reagent; termolecular silicones, $(R_2SiO)_3$, dihydric silicols, $R_2Si(OH)_2$, and substituted metasilicic acids, $R{\cdot}SiO{\cdot}OH$, may also be employed for this purpose.

The following compounds were prepared: *Benzyldiethylsilicol*, $SiEt_2(CH_2Ph)\cdot OH$; *benzylethylpropylsilicol*, $SiEtPr(CH_2Ph)\cdot OH$; *phenylmethylethylsilicol*, $SiMeEtPh\cdot OH$; *phenyldiethylsilicol*, $SiEt_2Ph\cdot OH$; *dibenzylmethylsilicol*, $SiMe(CH_2Ph)_2\cdot OH$; *triphenylsilicol*, $SiPh_3\cdot OH$; *tribenzylsilicol*, $Si(CH_2Ph)_3\cdot OH$. When phenylsilicon trichloride is treated with steam, it gives the anhydride of phenylmetasilicic acid, whereas with water it gives the acid. The anhydride is insoluble in all neutral liquids which were tried, and is probably highly polymerised.

18. "*o*-Carboxyanilides of the sugars." By James Colquhoun Irvine and Alexander Hynd.

The conditions under which the common reducing sugars condense with anthranilic acid have been ascertained, and it is found that the best results are obtained when solutions of the sugars in dilute alcohol are mixed with excess of the acid and kept in the cold for several weeks. In this way, *galactose-*, *mannose-*, *rhamnose-*, and *maltose-o-carboxyanilides* have been prepared. Lactose gave a negative result. In the case of fructose, the product could not be obtained pure, and the corresponding glucose compound has already been prepared (*Trans.*, 1909, **95**, 1553).

The condensation proceeds by reaction between the amino-group and the reducing group of the sugar, as all the products behave as acids. The compounds appear to be γ-oxides, as they show extremely rapid mutarotation comparable in magnitude and direction with that given by anilides and methylated anilides.

Glucose also condenses with alanine in a similar manner to give *glucosealanide* (m. p. 114°), which, judging from its optical behaviour, exists in α- and β-forms, which are interconvertible at 90°.

A parallel investigation carried out with tetramethyl glucose shows that reaction does not proceed readily between amino-compounds and the methylated sugar, and even ammonia and hydrogen cyanide are without action in the cold. *Tetramethyl glucose*-p-*phenetidide*, -*β-naphthylamide*, and -p-*toluidide* were, however, prepared. The latter alone is crystalline (m. p. 144°), and shows extensive mutarotation.

19. "The iodobenzenemonosulphonic acids. Part III. 2:3-Di-iodo- and 2:3:4:5-tetraiodo-benzenesulphonic acids." By Mary Boyle.

2:3-*Di-iodobenzenesulphonic acid* has been prepared by treating *p*-nitroaniline-*o*-sulphonic acid with iodine chloride, the nitro-group

being removed after the displacement of the amino-group by iodine. A new and convenient method of obtaining the initial nitroamino-acid in large quantities has been devised.

The di-iodosulphonic acid separates from mineral acid solutions in shining crystals, and yields crystalline salts and a well-characterised *chloride*; its *methyl* and *ethyl* esters have been prepared. The *tetraiodo-acid* is prepared from *m*-iodoaniline-*p*-sulphonic acid; its *chloride* differs from those containing two or three iodine atoms in possessing a distinct yellow colour.

20. "Occurrence of pentathionic acid in natural waters." By James Scott Maclaurin.

Pentathionic acid has not previously been found in natural waters. This may be due to the fact that in ordinary analyses of mineral waters no special search is made for such compounds. Some account of the circumstances that led to the discovery of the occurrences of the acid should therefore be of interest.

The water in which it was found was obtained from a lake on White Island. This island, which is the summit of a volcano, lies in the Bay of Plenty about thirty miles from the mainland. The lake covers an area of approximately 15 acres, and has a mean temperature of about 110° (Fahr.). The water is of a very unusual character, containing a great variety of salts and much free hydrochloric acid. In examining it for iodine by the potassium nitrite test, the author noticed the formation of a brown colour, which suggested the presence of a ferrous salt, but, on titrating with potassium permanganate, more permanganate solution was used than the iron (previously determined gravimetrically) could require, even if all were in the ferrous state, and judging by the colour of the water, much of the iron was in the ferric state. There was no organic matter to cause this excessive reduction, and on adding $N/10$-iodine solution no appreciable action took place, showing that the reduction could not be caused by sulphur dioxide or hydrogen sulphide. After removing sulphates by means of excess of barium chloride, and heating the filtrate with bromine water, a further precipitate of barium sulphate was formed, showing that some sulphur compound was present. It seemed probable that this was one or more of the polythionic acids, most probably pentathionic acid. In order to prove the truth or otherwise of this surmise, the water was boiled with mercuric cyanide (Debus, *Trans.*, 1888, **53**, 278). The reaction between mercuric cyanide and pentathionic acid is as follows:

$$Hg(CN)_2 + H_2S_5O_6 = HgS + S_2 + 2SO_3 + 2HCN.$$

If the mercury in the precipitate ($HgS + S_2$) be determined, the equivalent amount of hydrogen in the pentathionic acid can be calculated, and, by precipitating the SO_3 in the filtrate as barium sulphate, the oxygen and part of the sulphur can be estimated. The remainder of the sulphur can be determined in the first precipitate ($HgS + S_2$). The results so obtained approximated roughly to the formula $H_2S_5O_6$. The value for oxygen was, however, too high, and it was thought probable that this was due to the oxidising action of the ferric chloride and hydrogen chloride present in considerable quantities in the water. Attempts to remove these substances by the ordinary methods were unsuccessful, but the difficulties were met by shaking the water with slightly less magnesium oxide than was necessary to neutralise the free acid, and then precipitating the iron with potassium ferrocyanide.

Although the hydrochloric acid could be nearly neutralised by this means, the chlorides so formed reacted with the mercuric cyanide, so that instead of a precipitate of the composition $HgS + S_2$, one containing a large proportion of mercuric chloride was obtained. This rendered the determination of the hydrogen in the pentathionic acid more difficult and less trustworthy than in the absence of mercuric chloride. It was therefore decided to be satisfied with the approximate values for hydrogen already found, but to re-determine the sulphur and oxygen.

For this purpose 2000 c.c. of the water were precipitated in the cold with slightly less barium chloride solution than was necessary to throw down all the SO_3. After twenty-four hours, the barium sulphate was collected, and the filtrate was divided into three portions, *A*, *B*, and *C*. In *A*, the small amount of SO_3 still remaining was estimated by adding excess of barium chloride and keeping for twenty-four hours. This determination was made in the cold, because boiling causes slight decomposition of pentathionic acid. In *B*, the total sulphur was determined by oxidising with bromine water and precipitating with barium chloride. *C* was boiled with mercuric cyanide, the precipitate collected, and the SO_3 in the filtrate determined by boiling with solution of barium chloride. By subtracting the amount of barium sulphate obtained in *A* from the amounts found in *B* and *C* respectively, the sulphur and oxygen of the pentathionic acid were readily calculated. The results so obtained gave $S_5O_{5\cdot92}$.

The complete analysis of the water, in percentage composition, is as follows:

SiO_2	0·0080	Mn	0·0014
TiO_2	0·0030	Al	0·3330
SO_3	2·6534	Ca	0·1497
CO_2	0·0130	Mg	0·0790
P_2O_5	nil	K	0·0884
B_2O_3	0·0310	Na	0·2154
As_2O_3	0·00056	Mo	trace
Cl	4·8210	Cu	,,
Br	0·0034	NH_4	0·0091
I	trace	H (in HCl)	0·1328
O (basic)	0·5306	$H_2S_2O_6$	0·0240
Fe	0·1456		9·24236

These results may be re-stated as follows:

NH_4Cl	0·0273	$MnSO_4$	0·0038
KCl	0·1654	$CuSO_4$	trace
NaCl	9·0379	MoO_3	,,
KBr	0·0051	SiO_2	0·0080
KI	trace	TiO_2	0·0030
Na_2SO_4	9·6191	B_2O_3	0·0310
$MgSO_4$	0·3948	As_2O_3	0·00056
$CaSO_4$	0·5090	CO_2	0·0130
$Al_2(SO_4)_3$	2·1090	HCl	4·8338
$Fe_2(SO_4)_3$	0·2600	$H_2S_2O_6$	0·0240
$FeSO_4$	0·1976		9·24236

21. "β-Methyl-$\Delta^{\alpha\lambda}$-dodecadiene and β-methyl-$\Delta_{\alpha\gamma}$-decadiene." By Victor John Harding, Gertrude Maud Walsh, and Charles Weizmann.

An account was given of the preparation of the above-mentioned hydrocarbons from the corresponding tertiary alcohols:

$$CH_2{:}CH{\cdot}[CH_2]_8{\cdot}CMe_2{\cdot}OH \longrightarrow CH_2{:}CH{\cdot}[CH_2]_8{\cdot}CMe{:}CH_2.$$

$$CH_3{\cdot}[CH_2]_5{\cdot}CH{:}CH{\cdot}CMe_2{\cdot}OH \longrightarrow CH_3{\cdot}[CH_2]_5{\cdot}CH{:}CH{\cdot}CMe{:}CH_2.$$

22. "Determination of the vapour pressures of hydrates by a dynamical method." (Preliminary note.) By James Riddick Partington.

The vapour pressures of copper sulphate hydrate ($CuSO_4,5H_2O$) and racemic acid hydrate have been determined by comparing the amounts of water removed from the hydrate and from pure water by a stream of air in a special apparatus.

The values in the first case are higher than the tensimetric (static) values; in the latter case, the vapour pressures exhibit a maximum with respect to extent of dehydration as independent variable. Both phenomena are found to be mathematical consequences of the initial formation of an unstable lower hydrate, or unstable anhydrous substance, which passes slowly into a stable form.

23. "A simple demonstration of Gibbs's phase rule." By James Riddick Partington.

The proof of the phase rule given by Gibbs (*Scientific Papers*, vol. 1, pp. 62—100) is far too difficult to present to beginners in physical chemistry, and the following much simplified exposition of Gibbs's original demonstration has been found quite intelligible to students, and may be useful to teachers.

The assumption is made that it is possible to have a state of equilibrium between several phases at a definite temperature and pressure; this will be characterised by certain definite relations between the compositions of the phases (for example, a solid salt, saturated solution, vapour of the solvent).

Let p, θ = total pressure and temperature of the system.

n = number of components.

r = ,, ,, phases.

For each pair of phases there must be some condition satisfied for each component, such that this particular component does not pass from one phase to the other. The r-phases may now be arranged in $(r-1)$ pairs, namely, (1, 2), (2, 3), (3, 4), .. $\{(r-1), r\}$, and there will therefore be $(r-1)$ conditions to be satisfied for each component in all the phases, that is, $(r-1)$ equations defining the equilibrium. It is evident that such pairs as (1, 3), (2, 4), etc., need not be considered, since, if phase (1) is in equilibrium with phase (2), and phase (2) with phase (3), then (1) will also be in equilibrium with (3). If this were not the case, we could, by enclosing (1), (2), (3) in a ring-shaped tube, so that there are three surfaces of separation, set up a continuous circulation at a uniform temperature, which is contrary to the second law of thermodynamics.

For all the components there will therefore be $n(r-1)$ equations.

The number of variables is made up of:

(i) the pressure p,

(ii) the temperature θ,

(iii) the number of concentrations $= r(n-1)$, since for each phase we have $(n-1)$ fractions of the total mass for the n components, the last (nth) fraction, being obtained by subtracting the sum of all the others from the total mass, is fixed, and is not an independent variable, therefore:

$$\text{number of variables} = 2 + r(n-1).$$

The number of variables left undetermined

$$\begin{aligned} &= \text{number of variables} - \text{number of equations} \\ &= 2 + r(n-1) - n(r-1) \\ &= 2 + n - r. \end{aligned}$$

This, however, is defined as the number of degrees of freedom (F) of the system, hence:

$$F + r = n + 2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (a).$$

If any component is absent from a particular phase (for example, the vapour phase, or a solid phase), there is one variable less, but also one boundary condition less, for migration of that component cannot occur with respect to the phase considered. The equation (a) is therefore still true.

24. "Cholesterol and fatty acids."
By James Riddick Partington.

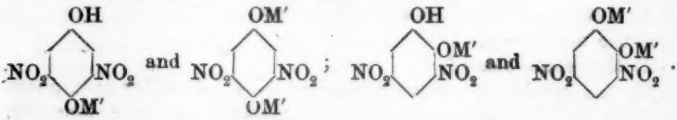
The solids separating from a fused mixture of cholesterol with palmitic, stearic, or oleic acid are found, by an examination of the freezing-point curves, to be either pure substances, or mechanical mixtures of these substances, and not compounds, as has been previously assumed.

25. "Salts of the dinitrodihydroxybenzenes."
By William Bayliss Shaw.

Although the dinitrodihydroxybenzenes have been known for some years, no systematic investigation of their salts has been carried out.

The author has prepared a complete series of the alkali-metal salts of 3 : 5-dinitroquinol, 3 : 5-dinitrocatechol, and 4 : 6-dinitroresorcinol by the addition of an alcoholic solution of the metallic hydroxide to the nitro-compound dissolved in an indifferent solvent, such as ether.

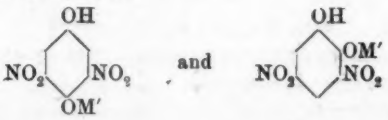
In the case of the quinol and catechol derivatives, two series of salts have been prepared, having the formulæ:



Only the neutral salts of dinitroresorcinol have been obtained.

A sharp colour distinction exists in the quinol and catechol series between the neutral and acid salts.

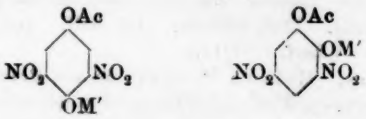
The acid salts of the forms



are all of an orange or red tint, whilst the neutral salts are almost black.

The neutral salts of dinitroresorcinol resemble the acid salts of the other two series, no darkly coloured substances having been found.

It has also been possible to prepare, although not in a high degree of purity, salts of the formulæ:



by employing the dinitro-diacetate in place of the free nitro-compound, since one of the acetyl groups is much more easily removed than the other.

By acting on a neutral salt with methyl sulphate, the corresponding monomethyl ether can be obtained. The introduction of two methyl groups by this means has not been accomplished.

All attempts to methylate 4 : 6-dinitroresorcinol with methyl sulphate have failed.

Some fifty new salts have been prepared, and it is hoped to publish full details shortly.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Bothamley, ***Charles Herbert.*** **The Ilford manual of photography.** pp. vi + 218. ill. Ilford. n.d. (*Recd.* 7/1/11.)

From Messrs. Ilford, Ltd.

Dyer, *Bernard,* **and Shrivell,** *F. W. E.* **The manuring of market garden crops.** pp. 144. ill. London 1910. (*Recd.* 16/1/11.)

From the Authors.

Martindale, *W. Harrison,* **and Westcott,** *W. Wynn.* "Salvarsan" or "606" (Dioxy-diamino-arsenobenzol). Its chemistry, pharmacy, and therapeutics. pp. xv + 77. London 1911. (*Recd.* 3/1/11.)

From the Publishers: Messrs. H. K. Lewis.

Scott, *Alexander.* **An introduction to chemical theory.** 2nd edition. viii + 272. London 1911. (*Recd.* 11/1/11.) From the Author.

II. *By Purchase.*

Fischer, *Ferdinand.* Kraftgas, seine Herstellung und Beurteilung. pp. viii + 236. ill. Leipzig 1911. (*Recd.* 18/1/11.)

Gildemeister, *Eduard,* and **Hoffmann,** *Friedrich.* Die ätherischen Öle. 2nd edition. Vol. I. pp. viii + 697. Leipzig 1910. (*Rec l.* 15/12/10.)

Neubauer, *Carl Theodor Ludwig,* and **Huppert,** *Karl Hugo.* Analyse des Harns. 11th edition. 1st half. pp. xiv + 682. ill. Wiesbaden 1910. (*Recd.* 18/1/11.)

Salmon, *William.* Medicina Practica: or, the Practical Physician: Shewing the true method of curing the most usual diseases incident to human bodies. . . To which is added, the chymical works of Hermes Trismegistus, Kalid King of Persia, Geber King of Arabia, Artefius Longævus the Jew, Roger Bacon, Nicholas Flammel's Hieroglyphicks. George Ripley's Marrow of Alchymie. And an account of their lives. pp. [xxviii] + 696. ill. London 1707. (*Reference.*)

Stift, *Anton,* and **Gredinger,** *Wilhelm.* Der Zuckerrübenbau und die Fabrikation des Rübenzuckers. pp. viii + 667. ill. Wien 1910. (*Recd.* 18/1/10.)

At the next Ordinary Scientific Meeting on **Thursday, February 2nd, 1911, at 8.30** p.m., the following papers will be communicated:

"The constancy of water of crystallisation in hydrated salts. Part I." By H. B. Baker and G. H. J. Adlam.

"Different methods of applying the Grignard reagent." By H. Davies and F. S. Kipping.

"The orientation of the nitro-group in nitromyristicinic acid." By A. H. Salway.

"The condensation of aromatic aldehydes with nitromethane." By F. G. P. Remfry.

"The phosphoric acids." By A. Holt and J. E. Myers.

"The determination of solubility coefficients by aspiration." By W. J. Jones.

"The triazo-group. Part XVI. Interaction of nitrosates and sodium azide." By M. O. Forster and F. M. van Gelderen.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 10/2/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 381.

Thursday, February 2nd, 1911, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Certificates were read for the first time in favour of Messrs.:

John Eric Collington, Claremont, Noel Road, Edgbaston.
Clement Arthur Crook, 4, Dry Clough Lane, Halifax.
William Henry Dickinson, Capt. (I.M.S.), M.B., Ch.B., Grant Medical College, Bombay.
Ralph Roscoe Enfield, B.A., Toynbee Hall, Commercial Street, E.
Oswald Mansell-Moullin, B.A., 69, Wimpole Street, W.
George Arncliffe Percival, 34, Cartwright Gardens, W.C.
Albert Cherbury David Rivett, B.A., B.Sc., Chemistry Dept., University, Melbourne.
William Arthur Reginald Wilks, M.A., 50, Stowheath Lane, Priestfield, Wolverhampton.

Of the following papers, those marked * were read:

*26. **"The constancy of water of crystallisation in hydrated salts. Part I." By Herbert Brereton Baker and George Henry Joseph Adlam.**

The authors have found that telluric acid always contains an excess of water over the calculated amount even when dried by phosphoric oxide for six months in a vacuum. This excess is due

to water occluded in the crystals, and water vapour cannot pass through a thin crystal of this substance. Determinations of the atomic weight of tellurium have been made by estimating the weight of water given off in the decomposition of telluric acid, as well as the total loss of weight. The mean of four determinations of the ratio TeO_2: O gave an atomic weight of 127·49. Experiments have been made with other hydrated crystals to find if such substances can be obtained in such a state as to be available for atomic weight determinations. By keeping the salts in an atmosphere containing a quantity of the partly dehydrated salt, such salts can be completely freed from adherent moisture. One such experiment with crystallised barium chloride ($BaCl_2,2H_2O$) gave 14·772 per cent. of water instead of 14·747. The similar method used by Guye and Tsakalotos (*J. Chim. phys.*, 1909, **8**, 3) gave with the same salt 14·6765 per cent. of water. It was shown that if a salt be completely dehydrated and left in a moist atmosphere, it will take up almost exactly the amount of water which corresponds with its water of crystallisation. For barium chloride the percentage was 14·750 instead of 14·747.

Further, it has been shown that air will not pass through a crystal when the latter is used to close a vacuum tube. Water vapour will, however, pass through hydrated crystals from a moist atmosphere to a dehydrating agent, but a partial dehydration of the crystal on the side nearest to the dehydrating agent seems to be necessary. Water vapour will not pass through anhydrous crystals, and therefore occluded water cannot be removed by placing in a desiccating atmosphere.

Discussion.

The President asked whether it was possible to obtain anhydrous telluric acid, H_2TeO_4, and whether the ortho-acid, H_6TeO_6, could be made by allowing the more or less anhydrous acid to take up moisture from an unsaturated atmosphere.

Dr. Senter said that if he understood the author rightly it was claimed that drying a salt hydrate over a mixture of the same hydrate and the anhydrous salt would remove all the moisture from the surface of the hydrate crystals. The method in question would ensure against dehydration being carried too far, but it appeared open to doubt whether it could be relied on to effect the complete removal of adsorbed moisture in all cases when one remembered the remarkable tenacity with which such moisture was sometimes held. The data given by the authors showed that the method was effective for barium chloride, but other salt hydrates in crystalline form might conceivably have much greater power of retaining adsorbed

moisture. He wished to ask Dr. Baker if further data were available on this point.

Dr. R. Lessing asked if the size of crystals had any influence on the amount of "adherent" or "occluded" water, and whether it was possible to facilitate the removal of this water by finely grinding the crystals.

In reply to the President, Dr. Baker said that anhydrous telluric acid took up water with extreme slowness. It was insoluble in water, and it did not become completely hydrated by remaining in water for three months. In answer to Dr. Senter, it was stated that the experiments now in progress would decide whether the method was a general one.

*27. "**The triazo-group.**" **Part XVI. Interaction of nitrosates and sodium azide.**" **By Martin Onslow Forster and Frederik Marinus van Gelderen.**

The azoimide nucleus may be substituted for the nitroxyl group in nitrosates and ethereal nitrates.

β-Triazo-β-methylbutan-γ-oxime, $N_3 \cdot CMe_2 \cdot CMe{:}NOH$, prepared from *iso*amylene nitrosate and sodium azide, melts at 34—35°; it is freely soluble in organic media, and is volatile in steam. *β-Triazo-β-methylbutan-γ-one*, $N_3 \cdot CMe_2 \cdot CO \cdot CH_3$, produced on hydrolysing the oxime with dilute mineral acids, boils at 42°/14 mm., and has D 1·0057/18°. The *semicarbazone*, $C_6H_{12}ON_6$, and *thiosemicarbazone*, $C_6H_{12}SN_6$, melt at 127° and 106—107° respectively.

The triazo-ketone leads to the amino-ketone on reduction, but this is stable only in the form of salts; alkalis convert these into hexamethyldihydropyrazine, which has been lately described by Gabriel (*Ber.*, 1911, **44**, 57).

*28. "**The triazo-group. Part XVII. Nitroso-azides of pinene and terpineol.**" **By Martin Onslow Forster and Sidney Herbert Newman.**

Nitroso-azides may be prepared by interaction of nitroso-chlorides and sodium azide. *Pinene nitrosoazide*, $C_{10}H_{15}(:NOH) \cdot N_3$, crystallises in brilliant, transparent prisms, melting at 120°; it is unimolecular, and the *acetyl* derivative melts at 64°. Alcoholic piperidine or sodium ethoxide gives rise to nitrosopinene. An *isomeride* of pinene nitrosoazide arises when the original material is heated with water, and melts at 126°, the *acetyl* derivative melting at 71°; it also yields nitrosopinene with alcoholic sodium ethoxide, but the continued action of hot water leads to the oxime

of hydroxydihydrocarvone, melting at 133·5°. The last-named substance is produced also by the action of alcoholic sodium ethoxide on *terpineol nitrosoazide*, $OH \cdot C_{10}H_{16}(:NOH) \cdot N_3$, which is prepared from terpineol nitrosochloride and sodium azide, and melts at 111°.

*29. "The synthesis of 3-β-aminoethylindole." By Arthur James Ewins.

The condensation of γ-aminobutyrylacetal and phenylhydrazine, by heating with zinc chloride to 180°, yields *3-β-aminoethylindole* (m. p. 146°), the amine derived from tryptophan by loss of carbon dioxide. Its most characteristic salt is the *picrate*, red needles, m. p. 242—243°.

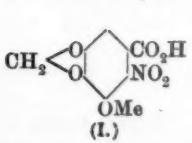
The *hydrochloride*, *picrolonate*, and *benzoyl* derivative were also described. The base is physiologically active.

Discussion.

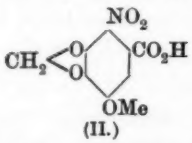
In reply to Dr. Pyman, Mr. Ewins stated that the yield of 3-β-aminoethylindole was from 40 to 50 per cent. of the theoretical.

30. "The orientation of the nitro-group in nitromyristicinic acid." By Arthur Henry Salway.

In a previous investigation (*Trans.*, 1909, **95**, 1155) the author had occasion to prepare nitromyristicinic acid, the constitution of which could be represented by one of the two following formulæ:



(I.)



(II.)

It has now been shown that this acid may be converted into cotarnic acid by the transformation of the nitro-group into a carboxylic group. The constitution of nitromyristicinic acid must therefore be represented by formula (I).

31 "The condensation of aromatic aldehydes with nitromethane." By Frederic George Percy Remfry.

The facility with which aromatic aldehydes condense with nitromethane in the presence of alcoholic potash is affected by the nature and position, with regard to the aldehyde radicle, of any

substituting groups in the benzene ring. An attempt was made to ascertain the conditions which govern the condensation, and for this purpose a number of aldehydes, with different substituents variously placed in the ring, were condensed with nitromethane. The results obtained, however, did not permit of any generalisation being put forward, owing to the fact that anomalies were observed in some cases which at present have not been satisfactorily explained.

The following compounds were described: *ω-Nitro*-o-, -m-, and -p-*hydroxystyrene*, $OH \cdot C_6H_4 \cdot CH{:}CH \cdot NO_2$ (m. p. 133—134°, 132—133°, and 165° respectively); *ω-nitro*-p-*acetoxystyrene* (m. p. 158—159); *ω-nitro*-p-*benzoyloxystyrene* (m. p. 156°); *ethyl ω-nitrostyryl*-p-*oxyacetate*, $NO_2 \cdot CH{:}CH \cdot C_6H_4 \cdot O \cdot CH_2 \cdot CO_2Et$ (m. p. 82°); *ethyl ω-nitrostyryl*-m-*oxyacetate* (m. p. 147—148°); p-*chloro-ω-nitrostyrene* (m. p. 111—112°); *ω-3-dinitro*-2-*hydroxystyrene* (m. p. 174—175°); *ω-3-dinitro*-4-*methoxystyrene* (m. p. 165—166°); *β*-3: 5-*trinitro*-4-*methoxy-α-phenylethanol*,

$$OMe \cdot C_6H_2(NO_2)_2 \cdot CH(OH) \cdot CH_2 \cdot NO_2;$$

β-nitro-2: 5-*dihydroxyphenylethanol* (m. p. 182°); *ethyl* 3-*aldehydosalicylate*, $CHO \cdot C_6H_3(OH) \cdot CO_2Et$ (m. p. 66—67°); *ethyl* 5-*aldehydosalicylate* (m. p. 69°), and its 3-*nitro*-derivative (m. p. 79—80°); *ω-nitro*-2-*hydroxy*-3-*carboxystyrene* (m. p. 231°); 3-*nitro*-5-*aldehydosalicylic acid* (m. p. 177°); 5-*nitro*-3-*aldehydosalicylic acid* (m. p. 195—196°), and 1-*ω-nitrovinyl-β-naphthol* (m. p. 187—188°).

32. "The phosphoric acids."
By Alfred Holt and James Eckersley Myers.

The experiments carried out by the authors lead to the following conclusions:

(1) Pyrophosphoric acid is formed as an intermediate compound during the hydration of metaphosphoric acid.

(2) The rate of hydration does not accord with any simple order of reaction.

(3) Meta- and pyro-phosphoric acids, when prepared by dehydrating the ortho-acid, give complex molecules in solution, but when prepared by decomposing the corresponding lead salts, simpler molecules result.

33. "The determination of solubility coefficients by aspiration."
By William Jacob Jones.

If a volume V c.c. of air be bubbled through a volume v c.c. of a well-stirred solution containing initially a grams of gaseous solute, and if the air in its passage through the solution abstract and

carry along with it c grams of solute, then the solubility coefficient s of that gas in the liquid is given by the expression:

$$s = \frac{V}{v.\log_e \frac{a}{(a-c)}}.$$

A form of apparatus has been devised whereby an accurate knowledge of the quantities V, v, a, and c, and consequently of s, is rendered possible.

34. "α-Amino-α-phenylacetamide and some of its derivatives." By Charles Hugh Clarke and Francis Francis.

α-Amino-α-phenylacetamide, $C_6H_5{\cdot}CH(NH_2){\cdot}CO{\cdot}NH_2$, is easily obtained, in the form of its *benzylidene* derivative, by the action of potassium hydroxide solution and ammonia on benzaldehyde-cyanohydrin in the presence of benzaldehyde. From this condensation product the free base itself is isolated by the action of phenylhydrazine with subsequent separation, based on the solubility of α-amino-α-phenylacetamide in water.

α-Amino-α-phenylacetamide is a strong base, and easily condenses with aldehydes. Its *carbethoxy*-derivative lends itself so readily to the formation of hydantoin that this constitutes the best method for the formation of substances of this class. On the other hand, no derivatives of the base could be prepared from which it was possible to isolate six-membered cyclic substances.

35. "Methylammonium nitrite." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

Methylammonium nitrite, $CH_3{\cdot}NH_3{\cdot}NO_2$, is formed in the interaction of mercuric nitrite and methylamine, and it is readily prepared by triturating methylamine hydrochloride with silver nitrite in the presence of a little water. On evaporating in a vacuum the filtrate after removal of silver chloride, lustrous crystals are obtained.

Methylammonium nitrate has a pale greenish-yellow colour, and is extremely deliquescent. It decomposes when kept in a desiccator, and, when heated, methyl alcohol and nitrogen are produced together with some secondary products of decomposition.

36. "The picraminobenzoic acids and their salts." By James Codrington Crocker and Frank Matthews.

The three picraminobenzoic acids and the salts derived from them were described. The ordinary salts are generally of the "acid"

type, containing two equivalents of the acid radicle to one of the base. The "semi" or acid salts have the general formula $CO_2M{\cdot}C_6H_4{\cdot}NHR,CO_2H{\cdot}C_6H_4{\cdot}NHR$ (where R denotes the picramyl group). This type of salt is only moderately soluble in water, and in most cases is completely hydrolysed even in the cold by excess of water, with precipitation of the acid, alkali remaining in solution. The "normal" salts are easily soluble in water, and show little hydrolysis in solution. The following substances were prepared:

o-*Picraminobenzoic acid* (m. p. 270°) and the acid o-*picraminobenzoates* of sodium, potassium, ammonium, methylamine, ethylamine, aniline, and pyridine; also the normal *silver* salt of *o*-picraminobenzoic acid.

m-*Picraminobenzoic acid* (m. p. 234°) and the acid m-*picraminobenzoates* of sodium, potassium, methylamine (two salts), ethylamine, and guanidine; also the normal *potassium* salt of *m*-picraminobenzoic acid.

p-*Picraminobenzoic acid* (m. p. 285°) and the acid p-*picraminobenzoates* of potassium and methylamine, and the normal salts of sodium and ammonium.

Quantitative experiments on the hydrolysis by water of the acid potassium salt of the *o*-acid were also carried out. It was shown that when the salt was in excess, equilibrium was attained when a certain constant concentration of alkali in solution was reached (about $N/250$ at 25°).

37. "New derivatives of *d*-glucosamine."
By James Colquhoun Irvine, David McNicoll, and Alexander Hynd.

Glucosamine hydrochloride reacts with acetyl bromide to give *bromotriacetylglucosamine hydrobromide* (m. p. 149—150°, $[\alpha]_D$ +148·4°), which serves as the starting point in the preparation of a number of glucosamine derivatives. The compound exists in α- and β-forms, shows normal mutarotation when dissolved in anhydrous acetone, and condenses readily with hydroxy-compounds. When acted on by traces of water, it is completely converted into glucosamine hydrobromide, owing to hydrolysis and the slow removal of the acetyl groups. By condensation with methyl alcohol, in the presence of pyridine, it gives *triacetylmethylglucosamine hydrobromide* (m. p. 230—233°), which has $[\alpha]_D$ +20·2° in methyl-alcoholic solution, and behaves as a β-glucoside. The acetyl groups may be eliminated from this compound by boiling with barium hydroxide, or by the action of dilute alcoholic hydrogen bromide in the cold, the reaction giving *methylglucosamine* as a strongly alkaline glucosidic syrup.

The *hydrochloride* of the latter appears to be a mixture of α- and β-stereoisomeric forms (m. p. 185—187°, $[\alpha]_D$ in water −19·5°); the compound closely resembles the aminomethylglucoside hydrochloride recently obtained by Fischer (*Ber.*, 1911, **44**, 132), and is possibly identical with it. The substance is, however, remarkably stable towards hydrolytic agents, but is converted into glucosamine hydrochloride by the action of concentrated hydrochloric acid. By similar treatment, all the compounds described give glucosamine salts, and are thus true derivatives of glucosamine. The conclusion is also drawn that the use of pyridine and silver salts in the preparation of the compounds has no effect on the configuration or on the amino-group.

The work is being continued with the object of correlating glucosamine with glucose and of preparing sugar complexes containing the glucosamine residue.

38. "The interaction of silver nitrate and potassium persulphate and its catalytic effect in the oxidation of organic substances." By Percy Corlett Austin.

A detailed analysis of the black precipitate which results from the interaction of aqueous solutions of silver nitrate and potassium persulphate was found to verify the assumption made by Marshall (*Proc. Roy. Soc. Edin.*, 1900, **23**, 163) that the silver persulphate, first formed, is partly decomposed by water according to the equation $Ag_2S_2O_8 + 2H_2O = Ag_2O_2 + 2H_2SO_4$. The precipitate appears to be a mixture of silver dioxide, silver persulphate, and a small percentage of water in proportions which vary slightly according to the conditions of the experiment. The catalytic effect of adding a trace of silver nitrate in the oxidation of various organic substances by means of aqueous potassium persulphate was studied. Whereas, in the absence of silver nitrate, oxidation did not appear to take place, the presence of a trace of this catalyst produced a very marked effect with toluene, when benzaldehyde and benzoic acid were quickly formed. Under similar conditions, thymol gave dithymol.

39. "The isomerism of ferrocyanides." By Samuel Henry Clifford Briggs.

The author finds that ferrocyanides exist in two forms, which are related to each other in the same way as are the α- and β-ferricyanides of Locke and Edwards (*Amer. Chem. J.*, 1899, **21**, 193, 413), and which have therefore been termed α- and β-ferrocyanides. The α-ferrocyanides of the alkali metals are lemon-yellow in colour,

and the β-ferrocyanides are orange- or amber-coloured. The difference in colour persists in solution, and when one form is converted into the other in solution, a corresponding change in colour is observed.

Acids convert the α-ferrocyanides into β-ferrocyanides; cyanides, ammonia, and alkalis effect the opposite transformation.

Nine ferrocyanides have been obtained in the two modifications. The α- and β-ferrocyanides of *l*-menthylammonium have $[\alpha]_D^{17} -42°$ and $-28°$ respectively in absolute alcoholic solution. The conversion of the α-ferrocyanide into the β-ferrocyanide is accompanied by a corresponding fall in specific rotation.

The α- and β-ferrocyanides are related to each other in the same way as the green and yellow platinocyanides of Levy (*Trans.*, 1908, **93**, 1446).

Reasons were adduced to show that the α- and β-ferrocyanides are stereoisomeric in accordance with the author's theory of complex salts (*Trans.*, 1908, **93**, 1564).

At the next Ordinary Scientific Meeting on **Thursday, February 16th, 1911, at 8.30 p.m.**, there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Different methods of applying the Grignard reagents." By H. Davies and F. S. Kipping.

"The formation and reactions of imino-compounds. Part XV. The production of imino-derivatives of piperidine leading to the formation of the ββ-*dl*-substituted glutaric acids." By F. B. Thole and J. F. Thorpe.

"The interaction of copper and nitric acid in presence of metallic nitrates. Part II." By E. H. Rennie and W. T. Cooke.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, February 16th, 1911.

Ashe, Albert, F.R.M.S.,
Laurie Square, Romford, Essex.

Technical Microscopist and Chemist. For thirty years Chief Assistant to Mr. John Hughes, F.C.S., F.I.C., Mark Lane, E.C.

John Hughes. W. C. Young.
Bernard Dyer. Fredk. J. Lloyd.
Arthur R. Ling. John Ruffle.
B. F. R. Newlands.

Allan, James, M.A., B.Sc. (Lond.),
Ravenscourt, Lerwick, Shetland Isles.

Science Master, Anderson Educational Institute, Lerwick. Ten years Teacher of Science, including Chemistry. Pupil of Dr. J. Mackenzie and Dr. A. McKenzie, Birkbeck College, and of Drs. H. and W. Fresenius, Wiesbaden. Analyst of rocks and soils, Shetland Field Club.

Alex. McKenzie. Henry Wren.
G. W. Clough. *G. H. Martin.*
G. D. Lander.

Anderson, Edward,
Hill View House, Waun Wen Road, Swansea.

Metallurgical and Analytical Chemist to Messrs. William Foster & Co., Morfa Copper Works, Swansea. Twelve years Senior Assistant,

and three years Chief Chemist, to above Company, who have Copper Works, Spilter Works, and Cobalt Works.

W. R. E. Hodgkinson. *Oliver Trigger.*
E. A. Tyler. *Robert Robertson.*
John W. Towers. *A. Vincent Elsden.*
A. H. Coote.

Barbary, John Ewart Trounce,
Vellansaundry, near Camborne.

Technical and Explosive Chemist. Five years Camborne School of Mines (Student). Five years Chemist in Charge, Safety Fuse Works, Roskear, Camborne, Cornwall.

J. J. Beringer. William Bate.
H. W. Hutchin. Andrew L. Scott.
Wm. T. Thomson.

Bate, Joseph,
59, Southwood Lane, Highgate, N.

Schoolmaster and Instructor of Chemistry. First Class Inter. B.Sc. (Lond.). Reading for final B.Sc. Teacher of Chemistry ten years, including five years as Instructor in Charge of Laboratory at Acland School, Kentish Town, N.W., 1905–10. Desirous of keeping in touch with modern developments of Chemistry.

Wm. W. Underhill. W. H. Mills.
William Waters Butler. Frank E. Weston.
A. E. H. Tutton.

Blackburn, Joseph Mayson,
346, Deane Church Lane, Bolton.

Analytical and Consulting Chemist and Perfumer of Watts Bros., 43, High Street, Manchester. First Class, Stage III., Organic and Inorganic Chemistry, South Kensington. Formerly Proprietor of Joseph Blackburn and Co., Chemical and Ammonia Manufacturers, 109, Baldwin Street, Bolton, and also former Demonstrator, Municipal Secondary School, Bolton.

Charles A. Fogg. Frank Smith.
Ernest Boardman. *T. M. Nightingale.*
Charles Smith. *J. L. Whiteside.*

Burbridge, Walter Norman,
"Uplands," Foxley Lane, Purley, Surrey.

Analytical Chemist. Certificated Student, Finsbury Technical

College. Late Assistant to Mr. A. Chaston Chapman, F.I.C. Chemist to the London General Omnibus Co., Ltd.

Alf. Chaston Chapman. H. Droop Richmond.
R. Meldola. H. Wilson Hake.
Fred. T. Harry.

Carmichael, John Fisher,
Tower Building, Liverpool.

Chemical Engineer. | B.Sc. (Vict.). Specialist in the technology of evaporation and distillation in Vacuo: Patent 26619, '07.

A. W. Titherley. J. S. Smythe.
J. F. Haws. *W. Collingwood Williams.*
Prosper H. Marsden.

Christopher, Harold,
"Mona," Lucien Rd., Tooting Common, S.W.

Research Student at University College, London. B.Sc. of London University, Second Class Honours in Chemistry. Conducted researches in organic chemistry for Dr. Smiles.

William Ramsay. J. Norman Collie.
Samuel Smiles. T. P. Hilditch.
P. May.

Cutner, Morris,
21, Bairstow Street, Preston, Lancs.

Science Master, The Grammar School, Preston. Student at King's College, London, 1906–09. Daniell Research Scholarship, King's College, London. B.Sc. (Lond.); Honours in Chemistry. I am desirous of keeping in touch with the latest advances in the science.

John M. Thomson. Herbert Jackson.
Patrick H. Kirkaldy. Charles A. Keane.
H. Burrows.

Devlin, James Edward A.,
Marist Brothers College, and Hazeldene, Baird Street, Uitenhage, Cape Colony.

Teacher (Science). Lecturer in Chemistry to Intermediate and B.A degree students. Certificated teacher (England). Science master Marist Bros. College, Uitenhage, Cape Colony.

P. T. O'Sullivan. Patrick J. D. Fielding.
Daniel J. O'Mahony. *Thos. Farrington.*
W. B. Harrington.

Dryden, Harold Edgar,

490, Stanton Road, Burton-on-Trent.

Analytical Chemist. Analytical Chemist at S. Allsopp & Sons, Ltd., Brewers, Burton-on-Trent. Ten years Assistant to Lawrence Briant, Esq., Public Analyst, 24, Holborn Viaduct. Student at City and Guilds' Technical College, Finsbury. Also of University Corr. College, Cambridge, etc.

Lawrence Briant. R. Meldola.
Harold Harman. F. Henry Streatfeild.
Léon E. Walling.

Eardley, James Furnival,

"Elmsdale," Broomhall Park, Sheffield.

Pharmaceutical Chemist. Minor and Major Qualifications of the Pharmaceutical Society, 1877.

Arthur W. Crossley. John Evans.
G. E. Scott-Smith. G. T. W. Newsholme.
J. Rymer Young.

Fielding, Michael Angelo,

8, St. Joseph's Place, Cork.

Chemist. Member of Pharmaceutical Society of Great Britain.

Patrick J. D. Fielding. Daniel J. O'Mahony.
P. T. O'Sullivan. *Thos. Farrington.*
A. E. Dixon.

Gardner, William Temple,

Bruern, Alexandra Road, Upper Parkstone, Dorset.

Chemist to Bournemouth Gas and Water Co. Member of the Pharmaceutical Society of Great Britain. At present, and during the past seven years, Works Chemist to the Bournemouth Gas and Water Company.

Harold G. Colman. Philip G. G. Moon.
Hubert Painter. *Fred. Hudson-Cox.*
George Brownen.

Griffiths, Evan Dalton, B.Sc.,

9, Wanstead Park Avenue, Manor Park, E.

Science Master (Chemistry and Physics), East Ham Technical College. Three years at University College of Wales, Aberystwyth, where I studied Chemistry under Dr. Lloyd Snape and Dr. Sudborough. B.Sc. degree, including Inorganic and Organic final

course, 1901. Nine years' experience as Chemistry Master and Lecturer.

W. H. Barker. A. E. Dunstan.
W. T. Clough. T. P. Hilditch.
R. W. Wilson.

Hall, Arthur Bennett,
31, Dyer Street, Kirkham, Lancs.

Pharmaceutical Chemist. Minor and Major certificates of the Pharmaceutical Society.

Arthur W. Crossley. David J. Williams.
Chas. Horne Warner. Chas. Turner.
Charles Gilling.

Hampshire, Charles Herbert,
19, Brook Street, Ilkley, Yorks.

Demonstrator in Chemistry in the Pharmaceutical Society's School. Pharmaceutical Chemist. B.Sc. (Lond.).

Arthur W. Crossley. Charles Gilling.
Chas. Horne Warner. Horace Finnemore.
G. T. Morgan.

Harding, Henry George Alan,
Darling Street, Chatswood, Sydney, N.S.W.

Teacher and Demonstrator of Chemistry, Sydney Technical College. Hold an Associateship (honours) in Chemistry, Syd. Tech. College (includes Physics, Mining, etc.). For several years Consulting and Analytical Chemist to such large firms as North Shore Gas Co., Ltd.; Plymel Enamel Co., Ltd.; J. C. Ludowici & Sons, Ltd.; and Messrs. F. Konig & Co., Ltd., Manufacturers. For some years now have held teaching position in Chemistry at Syd. Tech. College. Completed chemistry course (Science Faculty) at Sydney University, and am now doing post-graduate practical physical chemistry in Prof. Fawsitt's private laboratory. Author of "Notes on Halley's Comet," read before, and published by, the Royal Society of N.S.W., etc., etc.

Charles E. Fawsitt. F. A. Eastaugh.
J. A. Schofield. F. B. Guthrie.
Henry G. Smith.

Horne, William Joseph Chetwynd,
c/o Messrs. Cleeve Bros., Lansdowne, Limerick.

Analytical Chemist. Member of the Society of Public Analysts, Great Britain and Ireland.

Walter Thorp. Daniel J. O'Mahony.
Arthur W. Thorp. H. M. Atkinson.
Richard J. Moss.

Hough, Bernard Grindrod,

The Chestnuts, Wardle Road, Sale, Cheshire.

Analytical Chemist. Employed in the laboratory of Benger's Food, Ltd., Manchester. Member of the Pharmaceutical Society of Great Britain. I am desirous of keeping abreast of the current theories in Chemistry, and of the latest discoveries and investigations in the science.

Jas. Grant.	Chas. Turner.
F. G. Richards.	*Stanley J. Peachey.*
Alfred Nixon.	*F. S. Sinnatt.*

Wm. Beamont Hart.

Hurst, Reginald,

50, Culverley Road, Catford, S.E.

Chemist to The Float Electric Co., Ltd., Adam Street, S.E., also of Chemical Laboratory of above-mentioned Company.

Ernest Barrett.	*S. Edward Sheppard.*
A. G. Francis.	*R. W. Sindall.*
W. Mann.	*Charles A. Keane.*

Jenkin, William Alfred,

6, Bella Vista, Rio Tinto, Spain.

Chief Chemist, Rio Tinto Mines Laboratory; formerly Assayer and Analytical Chemist at Callington, Cornwall.

John Shields.	*Robert J. Caldwell.*
George A. Pingstone.	*Robert Whymper.*
J. H. Pizey.	*William Robertson.*

Laws, Ernyst Graham,

"Alverna," Edith Road, Ramsgate.

Teacher of Science. Headmaster for Further Education, Isle of Thanet. Late Demy of Magdalen College, Oxford. B.A. (Oxon). First Class Honours Natural Science (Chemistry), 1908. Research on "Isomerism of Acetaldehyde-Phenylhydrazone" (to be published shortly).

William Odling.	Allan F. Walden.
J. E. Marsh.	N. V. Sidgwick.

T. S. Moore.

McBain, James William,

71, Cotham Brow, Bristol.

Lecturer in Inorganic and Physical Chemistry, University of Bristol. B.A. and M.A. (Toronto); Ph.D. (Heidelberg). Published papers: *Journ. Phys. Chem.*, **5**, 623–638 (1901); *Zeitschr. f Elektrochemie*, **11**, 215, 961 (1905); *Trans. Chem. Soc.*, **91**, 1683

(1907); *Philosoph. Mag.*, (6), **18**, 916–935 (1909); Dissert., Rössler und Herbert, Heidelberg (1909); *Zeitschr. f. physikal. Chemie*, **68**, 471–497 (1909); December (1910); *Proc. Washington Acad. Sciences*, **9**, 1–78 (1907); *Univ. Toronto Studies*, No. 67 (1907); *Ber. d.d. chem. Ges.*, **43**, 321 (1910). Further, *Trans. Chem. Soc.*, **91**, 1683–1687 (1907); *Philosoph. Mag.*, (6), **20**, 793–828 (1910), etc.

Francis Francis. Philip J. Worsley.
F. W. Rixon. Edward Russell.
F. Wallis Stoddart.

Miller, John Watterson,
Lynwood, Cantilupe Street, Hereford.

Medical Officer of Health; Med. Supt., Isolation Hospitals; School Med. Officer, and Police Surgeon, City of Hereford. Student: Inter. B.Sc. in Chemistry, Vict. Univ.; Chemistry in D.P.H., Cambridge; at present carry out analyses of water and sewage effluents. "Filtration and other Methods of Purification, on a large scale, of River Water Used for Drinking Purposes" (*Public Health*, April, 1910).

Prosper H. Marsden. J. S. Smythe.
J. F. Haws. *W. Collingwood Williams.*
A. W. Titherley.

Moore, Walter Roman,
55, Gloucester Street, Norwich.

Demonstrator in Chemistry, Royal College of Science, South Kensington, S.W. Associate of the Royal College of Science.

T. E. Thorpe. James C. Philip.
M. O. Forster. W. Godden.
G. T. Morgan. Charles S. Garland.

Page, Harold James,
Avondale, Meteor Road, Westcliff-on-Sea.

Demonstrator in Physiological Chemistry, University College, London. Student from 1907 to 1910 at University College, London, Chemical Department. Joint paper with Dr. Smiles in *J.C.S.*, 1910 Vol. 97.

William Ramsay. Samuel Smiles.
J. Norman Collie. W. Bradshaw Tuck.
A. J. Child.

Partington, Edward,
"Oakdene," Sedgley Park, Manchester.

Traveller in glues, gelatines, essences, soaps, etc., etc. Laboratory student: Chemistry, Physics, etc.

H. F. Coward. S. J. Peachey.
R. L. Taylor. F. S. Sinnatt.
F. G. Richards.

Peddle, Cyril James,

146, Barnsley Road, Cudworth, Nr. Barnsley.

Science Master, Grammar School. Degree of Master of Science, University of Sheffield. Joint author of paper on "Molecular Association in Aqueous Solution, Illustrated by Hydroxyl-containing Substances," read at British Association meeting at Sheffield, 1910.

W. Palmer Wynne. C. R. Young.
W. E. S. Turner. J. Kenner.
W. J. Jarrard. Ernest Witham.

Plews, Frank Henry,

28, Gellatly Road, St. Catherine's Park, S.E.

Head of Chemists' Manufacturing Department. Student, teacher and eight years in control of the manufacture of medicines, testing drugs, etc. Practical Chemistry—London College, Chamber of Commerce, etc. Reason for desiring admission: Chemistry is my daily work, also my recreation.

Ernest J. Parry. *William Stevenson.*
O. A. Elias. *W. H. Martindale.*
W. Chas. Sayers. *D. R. Boyd.*

Raper, Henry Stanley,

599, Spadina Avenue, Toronto, Canada.

Lecturer in Pathological Chemistry at the University of Toronto. Contributions to *Journal of Chemical Society*: (1) "Action of Sodium Hypochlorite on Benzenesulphonamides." (2) "Relation of Position Isomerism to Optical Activity, the Rotation of the Menthyl Esters of Chloro-, Bromo-, and Iodo-benzoic Acids," etc.

John Beresford Leathes. Julius B. Cohen.
Arthur Smithells. H. M. Dawson.
W. Lowson.

Stanford, Robert Viner,

Cardiff City Mental Hospital, Whitchurch, Glam.

Research Chemist to above institution. B.Sc. (Lond.); M.Sc. (Birm.); Ph.D. (Kiel); sometime a Priestley Research Scholar in the University of Birmingham.

Alex. McKenzie. Claude M. Thompson.
G. W. Clough. E. P. Perman.
Robt. D. Abell.

Summers, George Douglas,

Grammar School, Tideswell, Nr. Buxton. Home address Easington Lodge, Sproughton, Ipswich.

Assistant Master. Intermediate Science, London University, July 1907.

W. G. Boul. Thos. Sutcliffe.
E. A. Tyler. *William Jago.*
R. H. Aders Plimmer.

Thomson, David,
Viewpark, Letham Road, Strathaven, Scotland.

Assistant to Professor of Chemistry, Glasgow University. M.A., B.Sc., with special distinction in Chemistry, of Glasgow University, 1906. Ph.D. of Göttingen University, 1909. Late Robert Donaldson, Carnegie, and 1851 Exhibition Research Scholar in Chemistry. Since October, 1909, Assistant in the Organic Chemistry Department of Glasgow University. In December, 1910, appointed Professor of Chemistry in the Cotton College, Gauhati, Province of Eastern Bengal and Assam, India. Joint-author with Dr. T. S. Patterson of two papers on "The Influence of Solvents on the Rotation of Optically Active Compounds" (*Ber.*, 1907, 40, 1243; *Journal Chemical Society*, 1908, 93, 353). Author of "A Contribution to the Study of Tanacetone (β-Thujone)" (*Journal Chemical Society*, 1910, 97, 1502).

T. S. Patterson. Frederick Soddy.
John Ferguson. Cecil H. Desch.
Thomas Gray.

Verschoyle, Wiliam Denham,
15, Winch Building, Vancouver, B.C.

Mining Engineer. Work on "The Periodic Relations of the Elements," published in the *Chemical News*, May 8, 1908; *English Mechanic*, Sept. 18, 1908, and other articles.

W. Norman-Bott Henry Boyers.
James H. Pizey. *Henry Isaac Gorman.*
F. E. Matthews.

Waygood, Bertie James,
39, Marshall Road, Levenshulme, Manchester.

Chemist. Because my sole occupation is the analysis of Oils and Fats and their allied products. I hold a First Class Honours Certificate City and Guilds of London Institute for Oils and Fats, including candle manufacture.

Harcourt H. Phillips. J. Allan.
E. L. Rhead. *James Grant.*
Stanley J. Peachey.

Wink, Ian Gordon Sellar,

27, Panmuir Road, Cottenham Park, Wimbledon, S.W.

Manager of the Chemical Department, London Branch, China and Japan Trading Co. Was a pupil of the late Mr. John A. Wink, Manufacturing Chemist. Has taken much practical interest in the standards of purity for exported chemicals, and has made various contributions on this subject to English and Japanese journals.

John C. Umney.	Peter MacEwan.
Thomas Tyrer.	*Henry E. Stevenson.*
Ernest J. Parry.	*B. E. R. Newlands.*

Wood, Edward Escott,

Hurricane House, Brymbo, N. Wales.

Chemist and Metallurgist. Six years Chemist and Metallurgist to Brymbo Steel Co., Ltd.; 3 years Senior Assistant Chemist to Messrs. Armstrong, Whitworth & Co., Ltd., Manchester; 5 years Assistant Chemist, Cammell Laird & Co., Ltd., Sheffield.

H. Proctor Smith.	F. S. Sinnatt.
E. L. Rhead.	S. J. Peachey.

Jas. Grant.

Yates, Charles Fursdon,

"Ronaldene," Witham Rd., Isleworth.

Analytical Chemist, A. and F. Pears' Soap Works, Isleworth. *Perfumery and Essential Oil Record*, July 1910, article on "Cassia Oil." Student, Technical College, Finsbury, Chemical Dept., 1896–1899. Now engaged in manufacture, as above.

J. N. Goldsmith.	Clayton Beadle.
C. T. Bennett.	*John C. Umney.*

Henry P. Stevens.

The following Certificates have been authorised by the Council for presentation to Ballot, under Bye-law I. (3):

Acree, Solomon Farley,

Johns Hopkins University, Baltimore, Ind., U.S.A.

Associate Professor of Chemistry, Johns Hopkins University, Baltimore. Associate Professor of Chemistry in the Johns Hopkins University. Formerly Associate Professor in the University of Utah. Author of about fifty articles on various chemical subjects in the

Berichte der deutschen chemischen Gesellschaft, American Chemical Journal, Journal of American Chemical Society, etc.

Ira Remsen.	*W. H. Perkin.*
F. W. Clarke.	*R. Robinson.*
Charles E. Munroe.	*Arthur Lapworth.*

Emerson, Robert Leonard, A.B., M.D. (Harvard),
Boston, Mass., U.S.A.

Analytical and Medical Chemist; Medico-Legal Expert. Author of "Über das Auftreten von Oxyphenylaethylamin bei Pankreasverdauung und über fermentative CO_2-Abspaltung," in *Beiträge z. chem. Phy. u. Path.*, Bd. I., 1901 (501). Author of Vol. II. "Wharton and Stille's Medical Jurisprudence." Author of book entitled "Legal Medicine and Toxicology." Instructor in Physiological Chemistry at Harvard University Medical School, 1901–05. Assistant in Clinical Pathology, Boston City Hospital, 1902–07.

John W. Smith.	*J. M. Crafts.*
Leonard P. Kinnicutt.	*T. Lynton Briggs.*
	E. G. Love.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C. AND BUNGAY, SUFFOLK.

Issued 27/2/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 382.

Thursday, February 16th, 1911, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. S. Judd Lewis and Walter N. Haworth were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Samuel James Manson Auld, D.Sc., Ph.D., 65, Margery Park Road, Forest Gate, E.

Arthur Stewart Bowyer, M.Sc., The Woodlands, Chelford.

Cecil Reginald Crymble, B.Sc., 7, Upper Crescent, Belfast.

Oliver Statham Douse, B.Sc., Fern Bank, Glossop.

Alfred Henry Finniss-Wheldon, 446, Currie Road, Durban, Natal, S. Africa.

Henry Francis Harwood, M.Sc., Ph.D., Erlesdene, Park Road, Hale.

Thomas Riley Lucas, No. 3 Cantonments, Vizianagram, Madras, India.

Roney Forshaw Messervy, 73, Blenheim Crescent, W.

John Lawrence Robinson Pastfield, B.A., Olivevale, St. Thomas, Exeter.

Richard Garnet Penney, 40, Duesbery Street, Hull.

Robert Wright, M.A., Lauriston, Derryvolgie Avenue, Belfast.

The PRESIDENT announced that the Council had recommended the following gentlemen as Honorary and Foreign Members, and that a ballot for their election would be held at the next Ordinary Scientific Meeting of the Society:

Prof. Dr. Eugen Bamberger (Zürich).
Prof. Giacomo Ciamician (Bologna).
Prof. Dr. Paul Heinrich Ritter von Groth (Munich).
Prof. John William Mallet (Virginia).
Prof. Dr. Walther Nernst (Berlin).

It was stated that the following changes in the Officers and Council were proposed by the Council:

President to retire.—Prof. H. B. Dixon.

Vice-Presidents to retire.—Dr. J. J. Dobbie and Prof. F. S. Kipping.

Ordinary Members of Council to retire.—Mr. J. L. Baker, Dr. G. T. Beilby, Dr. J. T. Hewitt, and Dr. H. R. Le Sueur.

As President.—Prof. Percy F. Frankland.

As Vice-Presidents who have filled the office of President.—Prof. H. E. Armstrong, Prof. A. Crum Brown, Sir William Crookes, Sir James Dewar, Prof. H. B. Dixon, Dr. A. G. Vernon Harcourt, Prof. R. Meldola, Dr. H. Müller, Prof. W. Odling, Sir William Ramsay, Prof. J. Emerson Reynolds, The Right. Hon. Sir Henry E. Roscoe, Sir Edward Thorpe, and Sir William Tilden.

As Treasurer.—Dr. Alexander Scott.

As Hon. Secretaries.—Prof. Arthur W. Crossley and Dr. G. T. Morgan.

As Foreign Secretary.—Dr. Horace T. Brown.

As Vice-Presidents.—Dr. G. T. Beilby, Dr. J. N. Collie, Dr. M. O. Forster, Prof. A. Liversidge, Prof. W. J. Pope, and Prof. J. Walker.

As New Ordinary Members of Council.—Mr. W. R. Bousfield, Mr. C. F. Cross, Mr. A. R. Ling, and Dr. H. Marshall.

Dr. V. H. Veley, Dr. F. B. Power, and Prof. J. Millar Thomson were elected Auditors to audit the Society's accounts.

The PRESIDENT announced that Mr. G. H. Gabb had presented to the Society a portrait of Dr. John Jeffries, from the pastel by John Russell, R.A.

A ballot for the election of Fellows was held, and the following were subsequently declared elected:

Solomon Farley Acree.
James Allan, M.A., B.Sc.
Edward Anderson.
Albert Ashe.
John Ewart Trounce Barbary.
Joseph Bate.
Joseph Mayson Blackburn.
Walter Norman Burbridge.
John Fisher Carmichael, B.Sc.
Harold Christopher, B.Sc.
Morris Cutner, B.Sc.
James Edward A. Devlin.
Harold Edgar Dryden.
James Furnival Eardley.
Robert Leonard Emerson, A.B., M.D.
Michael Angelo Fielding.
William Temple Gardner.
Evan Dalton Griffiths, B.Sc.
Arthur Bennett Hall.
Charles Herbert Hampshire, B.Sc.
Henry George Alan Harding.
William Joseph Chetwynd Horne.
Bernard Grindrod Hough.
Reginald Hurst.
William Alfred Jenkin.
Ernyst Graham Laws, B.A.
James William McBain, M.A., Ph.D.
John Watterson Miller.
Walter Roman Moore.
Harold James Page.
Edward Partington.
Cyril James Peddle, M.Sc.
Frank Henry Plews.
Henry Stanley Raper.
Robert Viner Stanford, M.Sc., Ph.D.
George Douglas Summers.
David Thomson, M.A., B.Sc. Ph.D.
William Denham Verschoyle.
Bertie James Waygood.
Ian Gordon Sellar Wink.
Edward Escott Wood.
Charles Fursdon Yates.

Of the following papers, those marked * were read:

*40. "Different methods of applying the Grignard reagents." By Harold Davies and Frederic Stanley Kipping.

Attention was drawn to the fact that in many of the syntheses which involve the use of a Grignard compound, the preliminary preparation of an ethereal solution of this reagent is quite unnecessary, because the desired result may be attained by Barbier's method. It was shown by examples that tertiary alcohols may be obtained by mixing a ketone (not acetone, however) or an ester with an alkyl or aryl halogen compound, and then adding the mixture to magnesium in presence of ether; the formation of hydrocarbons (diphenyl, dibenzyl) as by-products, which is often a source of much trouble in using the magnesium aryl halogen compounds, is thus avoided. The method has been previously adopted in preparing certain silicon compounds (*Trans.*, 1908, **93**, 2006; 1909, **95**, 306), and, as was shown, may also be employed in the synthesis of alkyl derivatives of tin.

Discussion.

Dr. Alex. McKenzie referred to the preparation of the Grignard reagent from an aryl halide in the ordinary manner, when the

main reaction is accompanied by the secondary reaction, $XR + RMgX = R{\cdot}R + MgX_2$; thus diphenyl was formed during the preparation of magnesium phenyl bromide. Such hydrocarbons were not always readily separated from the reaction products, but the extent of their formation might be lessened by the device suggested by Schmidlin, who recommended the use of an excess of magnesium amounting to from twice to thrice the calculated quantity.

***41. "Molecular association and its relationship to electrolytic dissociation. The molecular complexity of halogen-containing compounds." By William Ernest Stephen Turner.**

The investigation was undertaken with the object of defining the conditions under which molecular association of halogen-containing compounds takes place, and to test whether such association could be attributed to the possession by the halogen atom of latent or residual valencies. The experimental work involved the examination, in indifferent solvents, of about sixty different substances, and information concerning other substances was collected from different sources. More than a hundred substances of different types, including salts, were inspected in the complete review.

The question of the molecular complexity of salts was approached through the halogen salts of organic nitrogen, oxygen, and sulphur bases, many of these salts being found soluble in chloroform. The information then obtained was applied to the metallic salts.

The chief conclusions were:

1. Molecular association of chlorine-containing compounds only occurs when the compound is electrically active, that is, is either an electrolyte or a conducting medium.

2. The degree of association in chloroform of the salts of organic bases is very high, the association factors ranging in different salts from about 1·5 to 12, in solutions which seldom exceed 10 per cent. Chlorides were always least, and iodides most associated. When salts of similar bases are compared, the degree of association decreases with the mass of the base.

3. With metallic salts, the iodides are least associated, and chlorides most. In salts derived from allied metals, the degree of association decreases with increase of the atomic weight, and increases with the electropositive character of the metal.

4. Molecular association is the complement of electrolytic dissociation. Substances dissociated in ionising media are associated in different solvents.

5. Latent valencies do not give rise to association, at least

directly. It is better to view association in connexion with the electrical properties of the substance.

Discussion.

Sir W. Ramsay drew attention to the fact that possibly chloroform as a solvent might exert "latent valencies," or "residual valencies," due to the possibility of chlorine acting not merely as a monad, but as a triad.

He also added that the main objection to the idea of "molecular compounds" was that molecules, as such, could not conduct; that molecules did not act as carriers of electricity: that property belonged exclusively to ions. Hence valency must be a property of ions, not of molecules, if there was any truth in the hypothesis that valency is due to the transit of electrons from one atom to another.

Dr. Philip drew attention to the fact that the molecular weight of ethyl alcohol in benzene, calculated from cryoscopic observations on 12 to 15 per cent. solutions, was four or five times the normal value, whereas the association factor of pure ethyl alcohol was about 3. He asked if Dr. Turner could offer any explanation of this difficulty.

Mr. Turner stated, in reply to Sir William Ramsay, that the possible combination of solvent and solute had been considered, but no evidence had been obtained during the investigation that such combination occurred. Moreover, in all cases, so far as the author was aware, combination between solvent and solute resulted, not in raising, but in *lowering* the molecular-weight values.

In reply to Dr. Barger, he considered that the use of pyridine as a solvent in the determination of molecular weights was objectionable for two reasons. It had a fairly high dielectric constant, and it combined with the solute.

With reference to Dr. Philip's question, the author could offer no plausible suggestion why alcohol should be so much more associated in benzene solution than in the liquid state.

In reply to Dr. Senter, Mr. Turner stated that the molecular complexities quoted of the haloid salts of the alkali metals were calculated by Walden by means of a formula which was free from the objections raised against the original Ramsay and Shields' formula. The results were also in accord with values obtained by a second method not involving a measurement of surface tension.

***42. "α-*p*-Hydroxy-*m*-methoxyphenylethylamine, and the resolution of α-*p*-hydroxyphenylethylamine." By Charles Watson Moore.**

The author has prepared α-p-*hydroxy*-m-*methoxyphenylethylamine* by the reduction of 4-hydroxy-3-methoxyacetophenoneoxime. The base is found to have a slight action on the blood pressure. The *hydrochloride* and the *benzoyl* derivatives have also been prepared and characterised.

α-*p*-Hydroxyphenylethylamine was prepared by Tutin, Caton, and Hann (*Trans.*, 1909, **95**, 2113), and was shown (*loc. cit.*) to exert an action on the blood pressure similar to, although much less than, epinephrine. Since the base contains an asymmetric carbon atom, it was considered of interest to ascertain whether the optically active bases, obtained by its resolution, would differ in physiological activity, as in the case of the *d*- and *l*-epinephrines (Cushny, *Pharm. J.*, 1909, **82**, 56), and the *d*- and *l*-hyoscyamines (Cushny, *J. Physiol.*, 1904, **30**, 176). The base has been resolved by means of its d-*camphorsulphonate*, although only the salt of the lævorotatory base has been obtained in a pure condition. Optically pure benzoyl derivatives have, however, been obtained from both the stereoisomeric bases. The effect on the blood pressure of the *l*- and *dl*-bases has been determined, but no difference in physiological activity was observed.

43. "The formation and reactions of imino-compounds. Part XV. The production of imino-derivatives of piperidine leading to the formation of the ββ-disubstituted glutaric acids." By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

It was shown that almost quantitative yields of the ββ-disubstituted glutaric acids can be obtained by condensing cyanoacetamide with ketones in the presence of piperidine or alkali hydroxide. The imino-piperidones which are initially formed decompose under the action of strong acids, yielding the substituted glutaric acids (compare *Proc.*, 1910, **26**, 295).

44. "The interaction of copper and nitric acid in presence of metallic nitrates. Part II." By Edward Henry Rennie and William Ternent Cooke.

The authors find that whereas in previous experiments at 59° and with 2*N*-acid, potassium nitrate had apparently no effect, and rubidium and cæsium nitrates a retarding effect on the dissolution of copper in dilute nitric acid, all these nitrates have either an

accelerating or retarding effect according to the conditions of temperature and concentration. With the same concentration of acid, and with potassium nitrate, the lower the temperature the less is the acceleration (it often becomes retardation), whereas the higher the temperature, the greater is the acceleration. With the same temperature, increase of concentration of acid tends to lessen acceleration. These statements seem also to hold good with rubidium and cæsium nitrates. The authors also find that the effect of the increase of volume of acid due to the solution in it of considerable quantities of nitrates is a factor not to be overlooked, inasmuch as it obviously diminishes the concentration of the acid, and of nitrous acid or other products formed during the reaction. They conclude that these fresh results tend to confirm the opinions expressed by them in their previous paper (*Trans.*, 1908, **93**, 1162).

45. **"The mechanism of Doebner and von Miller's quinaldine synthesis." By Humphrey Owen Jones and Percy Edwin Evans.**

Doebner and von Miller's well-known synthesis of quinoline derivatives from an aldehyde and an aromatic amine by heating with hydrochloric acid is represented by the equation:

$$C_6H_5\cdot NH_2 + 2CH_3\cdot CHO = C_{10}H_9N + 2H_2O + H_2$$

in the simplest case.

The molecule of hydrogen is used up mainly in reducing some of the aldehyde.

During the examination of the aldol bases,

$$R\cdot NH\cdot CHMe\cdot CH_2\cdot CHO,$$

formed from *m*-4-xylidine and similar amines (Jones and White, *Trans.*, 1910, **97**, 632), the transformation of these into quinoline derivatives by heat or by acids in the cold was studied, and was found to take place without perceptible evolution of gas.

The aldol bases cannot be reduced by nascent hydrogen, and the change was therefore further examined. It was found that no gas was evolved, and that the transformation of the aldol base from *m*-4-xylidine at 140—250° is represented by the following equation:

$$2C_6H_3Me_2\cdot NH\cdot CHMe\cdot CH_2\cdot CHO = C_9H_4Me_3N + C_9H_8Me_3N + 2H_2O.$$

The change is practically quantitative, equimolecular quantities of 2 : 6 : 8-trimethylquinoline (m. p. 45—46°) and 2 : 6 : 8-trimethyltetrahydroquinoline (m. p. 50—51°, b. p. 260—261°) being produced.

Similar results have been obtained with *p*-toluidine. The synthesis of these quinoline and tetrahydroquinoline derivatives can be effected in this way, namely, by isolating the intermediate

aldol base and heating it, much more cleanly and economically than by the usual method.

46. "A synthesis of derivatives of phenothioxin." By Thomas Percy Hilditch and Samuel Smiles.

The ethers of *p*-cresol and *p*-chlorophenol sulphoxides show the normal reactions of the thionyl group in sulphuric acid solution, whilst the corresponding hydroxy-sulphoxides do not. This abnormal behaviour is due to the formation of the cyclic phenothioxin derivatives, for example:

$$CH_3 \cdot C_6H_3 \begin{<} \begin{matrix} -O- \\ SO \end{matrix} \begin{>} C_6H_3 \cdot CH_3,$$

which have been isolated. The general character of the phenothioxin group was discussed.

47. "The nitration of acetylbenzoin and of stilbenediol diacetates." By Arthur Gordon Francis and Charles Alexander Keane.

Acetylbenzoin, on nitration with fuming nitric acid at 0°, yields a *mononitro*-compound, which is also obtained when the nitration is carried out at −15° in acetic anhydride solution by means of nitre and sulphuric acid. It forms almost colourless leaflets, melting at 125° (uncorr.). It is sparingly soluble in ether or light petroleum, readily so in chloroform, acetone, or benzene, and somewhat less soluble in boiling 90 per cent. alcohol. When oxidised with sulphuric acid and potassium dichromate, it yields molecular proportions of acetic acid, benzoic acid, and *p*-nitrobenzoic acid. It has thus the following structure:

$$\underset{(1)}{NO_2} \cdot C_6H_4 \cdot \underset{(4)}{CH}(OAc) \cdot CO \cdot C_6H_5.$$

Hydrolysis with acids or alkalis yields, not nitrobenzoin, but condensation compounds, which are under further investigation.

Both *α*-stilbenediol diacetate (melting point 153°) and *β*-stilbenediol diacetate (melting point 110°), on nitration at −15° in acetic anhydride solution with nitre and sulphuric acid, yield benzoin mononitrate and a small quantity of a substance, possibly nitrobenzoin, melting at 188°, whilst *β*-stilbenediol diacetate is at the same time partly converted into the *α*-compound. No benzoin nitrate is formed at 0° or at −25°.

Benzoin mononitrate, $C_6H_5 \cdot CH(O \cdot NO_2) \cdot CO \cdot C_6H_5$, crystallises from 90 per cent. alcohol in brilliant white plates, melting at 167° (uncorr.). It is very sparingly soluble in ether or light petroleum. On hydrolysis with potassium hydroxide, it yields benzoin and potassium nitrate, and on heating with concentrated nitric acid benzil is formed.

48. "Experiments on the formation of 4(or 5)-β-aminoethylglyoxaline from histidine." By Arthur James Ewins and Frank Lee Pyman.

It has been found that by heating histidine (monohydrochloride) with (*a*) concentrated hydrochloric acid, (*b*) dilute (20 per cent.) sulphuric acid, and (*c*) potassium hydrogen sulphate in closed vessels at 265—270°, a maximum yield of 20 to 25 per cent. of the theoretical amount of the base, 4(or 5)-β-aminoethylglyoxaline (formed from histidine by removal of carbon dioxide), can be obtained. At temperatures below 240° no formation of the base takes place, whilst at 240—250° the main product of the reaction is racemic histidine.

By directly heating histidine above its melting point, only very small amounts of the base are produced. Somewhat better results were obtained by fusing the monobenzoyl derivative of histidine at about 240° in a vacuum and subsequently hydrolysing the reaction product.

Some new salts of racemic histidine, or 4(or 5)-β-aminoethylglyoxaline, and the dipicrate of natural histidine were described.

49. "The dissociation of cupric bromide, and some forms of glass manometer." By Colin Gyrth Jackson.

Three varieties of glass manometer were described, whereby it is possible to measure pressures of vapours in contact with no other material. Values of the dissociation pressure of cupric bromide at a series of temperatures were given, and their connexion shown to be adequately represented by an equation involving the constancy of the heat of dissociation, the applicability of the simple gas laws to bromine under the conditions of the experiment, and the first and second laws of thermodynamics.

50. "The determination of the dissociation pressures of hydrated salts by a dynamical method." By James Riddick Partington.

An account was given of experiments on three hydrates, in which the dissociation pressures have been measured by a dynamical method. The results were shown to be in agreement with the view referred to in a previous communication (this vol., p. 12).

51. "The influence of conjugated linkings on general absorptive power. Part I. The absorption spectra of some benzene derivatives." By Cecil Reginald Crymble, Alfred Walter Stewart, Robert Wright, and William Gerald Glendinning.

An examination of the absorption spectra of twenty-eight benzene derivatives (supported by a similar investigation of about the same number of aliphatic and alicyclic substances) has shown that it is possible to trace some connexion between the chemical structure of an unsaturated carbon compound and its general absorptive power. Of two isomeric substances containing two or more double bonds, the compound the molecule of which contains the longest chain of conjugated linkings appears to have the greater power of general absorption in the region of the spectrum above that in which any absorption band makes its appearance. In the case of two isomeric substances like atropic and cinnamic acid, the isomeride, which contains what Thiele terms "crossed double bonds" (for example, atropic acid), will have less absorptive power than the isomeride which contains a simple conjugated system of linkings, such as occurs in cinnamic acid. It was pointed out that this rule will furnish additional assistance in the determination of the constitutions of terpenes containing two double bonds the relative positions of which are difficult to ascertain.

52. "The optical properties of acids containing three hydrocarbon residues directly attached to an asymmetric carbon atom. Part I. The synthesis of β-phenyl-β-methylvaleric acid and of *as*-methylethylsuccinic acid." By John Kenneth Harold Inglis.

Compounds containing an asymmetric carbon atom might be expected to be very stable when subjected to the action of racemising agents. In order to investigate this question, *β-phenyl-β-methylvaleric acid*, $CMePhEt{\cdot}CH_2{\cdot}CO_2H$, has been prepared, but as the substance is a liquid, and its salts are difficult to crystallise, it is not a suitable substance for this purpose. *as*-Methylethylsuccinic acid, however, is crystalline, and can be obtained fairly easily by the method used by Higson and Thorpe (*Trans.*, 1906, **89**, 1467). Methyl ethyl ketonecyanohydrin condenses with the sodium derivative of cyanoacetic ester to give a liquid boiling at 165°/19·5 mm., which has the formula $C_{10}H_{14}O_2N_2$. This liquid gives *as*-methylethylsuccinic acid on hydrolysis. The acid has been resolved by crystallisation of its quinine salt.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Redgrove, *Herbert Stanley.* On the calculation of thermo-chemical constants. pp. viii + 102. London 1909. (*Recd.* 19/1/11.)
From the Author.

Redwood, *Sir Boverton.* Petroleum. A treatise on the geographical distribution and geological occurrence of petroleum and natural gas; the physical and chemical properties, production, and refining of petroleum and ozokerite; the characters and uses, testing, transport, and storage of petroleum products; and the legislative enactments relating thereto; together with a description of the shale oil and allied industries; and a full bibliography. 2 vols. pp. xxxii + 1064. ill. London 1906. (*Recd.* 25/1/11.) From the Author.

Richter, *Victor von.* Traité de chimie organique. Edited by *R.* **Anschütz** and *G.* **Schroeter.** Translated into French by *H.* **Gault.** Vol. I. pp. xxiv + 886. Paris 1910. (*Recd.* 24/1/11.)
From the Publisher: M. Ch. Béranger.

II. *By Purchase.*

Allen, *Alfred Henry.* Commercial organic analysis. Vol. IV. 4th edition. Edited by *W. A.* **Davis** and *Samuel S.* **Sadtler.** pp. viii + 466. ill. London 1911. (*Recd.* 21/1/11.)

Dictionary (An [explanatory) of the apparatus and instruments employed in the various operations of philosophical and experimental chemistry. With seventeen quarto copper-plates. By a Practical Chemist. pp. vii + 296. London 1824. (*Recd.* 20/1/11.)

Gmelin, *Leopold,* and **Kraut,** *K.* Handbuch der anorganischen Chemie. 7th edition. Edited by **Friedheim,** *C.,* and **Peters,** *Franz.* Vol I., etc. Heidelberg 1905 + *Reference.*

III. *Pamphlets.*

Clacher, *William.* The manufacture of carbons. (From the *Electrical Review,* 1911, **68.**)

Gabb, *George Hugh.* A recently-discovered portrait of Dr. Jeffries, by J. Russell, R.A. (From the *Connoisseur,* 1911, **29.**)

Meldola, *Raphael.* Evolution: Darwinian and Spencerian. The Herbert Spencer Lecture . . . 1910. pp. 44. Oxford 1910.

Philippine Islands. The mineral resources of the Philippine Islands. With a statement of the production of commercial mineral products during the year 1909. pp. 81. ill. Manila 1910.

Queensland. Report of the Agricultural Chemist for the year ending 30th June, 1910. pp. 23. ill. Brisbane 1910.

Seidell, *Atherton.* The solubilities of the pharmacopœial organic acids and their salts. pp. 98. Washington 1910.

Taffanel, *J.* Abstract of the reports of the French coaldust experiments conducted at the Liévin Experimental Station, 1907–10. Abstracted and translated by the "Colliery Guardian." pp. 82. ill. London 1910.

Zenneck, *J.* Die Verwertung des Luftstickstoffs mit Hilfe elektrischen Flammenbogens. pp. 29. ill. Leipzig 1911.

At the next Ordinary Scientific Meeting, on **Thursday, March 2nd, 1911, at 8.30** p.m., there will be a ballot for the election of Honorary and Foreign Members, and the following papers will be communicated:

"Potassium cupricarbonates." By S. U. Pickering.

"Studies in the camphane series. Part XXIX. A new phenylhydrazone of camphorquinone." By M. O. Forster and A. Zimmerli.

"Synthesis of dipeptides of lauric acid with glycine, alanine, valine, leucine, and asparagine." By A. Hopwood and C. Weizmann.

"Fluorone derivatives." By F. G. Pope and H. Howard.

"The constituents of *Witharia somnifera*." By F. B. Power and A. H. Salway.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 13/3/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 383.

Thursday, March 2nd, 1911, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. Frank H. Plews, C. F. Yates, and Thomas Callan were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Alfred Thomas Eggington, B.Sc., The Hawthorns, Ibstock, Leicester.
Arthur Alfred Eldridge, B.Sc., School House, Alpha Road, Surbiton Hill.
Edwin Burnhope Hughes, 5, Perham Road, West Kensington, W.
Leonard Owen Newton, St. Elba, Napoleon Road, St. Margaret's-on-Thames.
Eric Everard Walker, 210, Bedford Hill, Balham, S.W.
Henry Hough Watson, Braystones, via Carnforth.
William Wood, Katoomba, King Edward Avenue, Dartford.

A ballot for the election of Honorary and Foreign Members was held, and the following were subsequently declared duly elected:

Prof. Dr. Eugen Bamberger (Zürich).
Prof. Giacomo Ciamician (Bologna).
Prof. Dr. Paul Heinrich Ritter von Groth (Munich).

Prof. John William Mallet (Virginia).
Prof. Dr. Walther Nernst (Berlin).

The PRESIDENT announced that the Royal Academy of Sciences of Turin had given notice of the founding of a Vallauri Prize of 26,000 lire for the most important work in the domain of the physical sciences published during the period January 1st, 1915, to December 31st, 1918.

The PRESIDENT read the names of the Fellows recommended by the Council for election as Officers and Ordinary Members of Council for the year 1911 to 1912.

Of the following papers, those marked * were read:

***53. "Studies in the camphane series. Part XXIX. A new phenylhydrazone of camphorquinone." By Martin Onslow Forster and Adolf Zimmerli.**

The constitution of camphorquinonephenylhydrazone has been the subject of much speculation. Following their investigation of the hydrazones, semicarbazones, and phenylcarbamylhydrazones of camphorquinone, each of which was obtained in two interconvertible isomeric modifications, the authors have transformed the known camphorquinonephenylhydrazone into an isomeride, which stands in the same relation to the existing derivative as the β-members of the other pairs do to the respective α-compounds; they regard the isomerism as stereochemical.

Camphorquinone-β-phenylhydrazone, $C_8H_{14}<\begin{matrix}C{:}N\cdot NH\cdot C_6H_5\\ CO\end{matrix}$, prepared by heating the α-modification, is a bright yellow, crystalline substance, melting at 36°; it dissolves very readily in organic media, including petroleum. The one per cent. solution in alcohol has $[\alpha]_D$ 375°, which is raised to 397° by heating the liquid during twelve hours at 63°; under the same treatment the rotatory power of the α-phenylhydrazone falls from $[\alpha]_D$ 431° to 398°.

Camphorquinone-α-thiosemicarbazone, $C_8H_{14}<\begin{matrix}C{:}N\cdot NH\cdot CS\cdot NH_2\\ CO\end{matrix}$, melts at 174°, but the β-modification could not be isolated, being transformed too rapidly into *camphane-thiotriazine*,

$$C_8H_{14}<\begin{matrix}C{:}N\cdot N\\ C{:}N\cdot C\cdot SH\end{matrix}'$$

a bright yellow substance, melting at 207°. *Camphorquinonephenyl-*

thiocarbamylhydrazone, $C_8H_{14}<\begin{matrix}C{:}N\cdot NH\cdot CS\cdot NH\cdot C_6H_5\\ CO\end{matrix}$, prepared from both camphorquinonehydrazones and phenylthiocarbimide, melts at 184°.

Discussion.

The President asked whether there was any explanation of the great difference observed between the melting points of the α- and β-forms of the phenylhydrazone derivatives.

Mr. W. Robertson submitted that the isolation of a second form of camphorquinonephenylhydrazone of low melting point and high rotatory power was not necessarily at variance with the conclusion drawn from the mutarotation measurements that, in benzene solution, a labile form of practically no optical activity was present. The results could be harmonised by supposing the existence of three isomerides in alcoholic solution, the α-form (m. p. 190°) first undergoing a rapid change into a second form (this being the change examined in the non-ionising purified benzene), the second form then changing relatively slowly into the β-form (m. p. 36°), a conclusion supported by solubility measurements (*Trans.*, 1905, **87**, 1299).

It was also pointed out, in reply to Dr. Forster, that in Armstrong and Robertson's paper, the colouring material in solution was due to the complex: $\begin{matrix}C{:}N\cdot NH\cdot C_6H_5\\ CO\end{matrix}$, and the opinion was expressed that the amount of this form present was small (*loc. cit.*, p. 1278).

Dr. Veley expressed the opinion that the observed differences in the algebraical sum of the factors of chemical change (namely, the values of $K+K_1$) were probably due to the presence of a small quantity of the β-hydrazone in the α-derivative, which accelerated the transformation of the former into the latter compound. The case would be perfectly analogous to the acceleration observed in the transformation of rhombic into monosymmetric sulphur, of cyanic acid into cyamelide, and of the oxidation of oxalic acid by acid permanganate as affected by the presence of manganese sulphate. The explanation thus offered was probably identical with that proposed by Prof. Walker, though stated in a somewhat different form.

Dr. Lowry supported the view that three isomeric hydrazones of camphorquinone must now be recognised, the ordinary form of the compound being converted quickly at atmospheric temperatures (to the extent of 10 per cent.) into an isomeride of very low rotatory power, and slowly at a higher temperature (to the extent of about 50 per cent.) into the new isomeride described by Dr. Forster. An analogous case was that of nitrocamphor, which

changed quickly (to the extent of one-sixth) into the acidic pseudo-nitro-compound, but could be forced to undergo a further change of the Beckmann type, giving rise to a third isomeride, namely, camphoryloxime. Although the less stable isomerides could not be isolated, their existence in solution had been demonstrated by precisely the same methods as in the case of such well-known substances as gluconic and galactonic acids, which decomposed into lactone and water as soon as any attempt was made to separate them from their solutions.

Prof. GREEN remarked that the greater depth of colour of the β-isomeride, as compared with that of the α-isomeride, would be well explained by the *anti-* and *syn*-formulæ suggested by the authors, since the proximity of the NH group to the CO group in the *syn*-modification would favour a dynamic keto-enolic oscillation.

Dr. FORSTER, replying to the President, pointed out that the isomeric benzaldoximes melted at 35° and 128° respectively; moreover, the difference between the melting points of maleic and fumaric acids is 156°, greater therefore than that which separates the phenylhydrazones of camphorquinone. The necessity of now recognising three isomerides, claimed by Mr. Robertson and Dr. Lowry, was not accepted by the authors, who regarded Mr. Robertson's solubility experiments as capable of explanation by the new facts brought to light. Without denying that future investigation might reveal a third isomeride, it was difficult to recognise any justification for stating that it would be optically inactive. Dr. Forster agreed with Mr. Robertson's second point, namely, that in the latter's paper with Professor Armstrong, a material owing its colour to the complex $C{:}N{\cdot}NH{\cdot}C_6H_5$ was stated to be present in very small proportion, but reminded Mr. Robertson that the evidence furnished for its existence was limited to the bare statement of its occurrence; moreover, the yellow substance was entirely ignored in the later parts of their paper, which dealt only with the hypothetical, colourless "metameride having little, if any, optical activity."

*54. "Fluorone derivatives."

By Frank George Pope and Hubert Howard.

Phosphorus pentachloride converts 3-hydroxy-9-phenylfluorone into 3: 6-*dichloro*-9-*phenylxanthonium chloride*, an extremely reactive compound, which condenses readily with amines to produce compounds of the rosamine type, with potassium cyanide and with sodium ethoxide to form cyanoxanthen and xanthyl ethers respectively. Reasons were given for preferring a paraquinonoid

configuration for the fluorones; *phenylfluorone* and *phenylnaphthafluorone* were also described.

Discussion.

Prof. Green said that the fluoran dyestuffs seemed to occupy an intermediate position between the ortho-quinonoid and the para-quinonoid dyestuffs, and from many facts he was disposed to believe that they were usually in a state of oscillation between the two forms, or that they readily changed from one form to the other. In certain cases, as had been shown for quinolphthalein by Green and King, an ortho-quinonoid structure must be assumed.

*55. "The constituents of Withania somnifera."

By Frederick Belding Power and Arthur Henry Salway.

The material employed for this investigation represented the entire plant of *Withania somnifera*, Dunal (Nat. Ord. *Solanaceae*), and was obtained directly from South Africa. Both the roots and the overground portion of the plant responded to the tests for an alkaloid, and they were separately examined.

The investigation has shown that a number of substances present in the root are likewise contained in the leaves and stems of the plant. These substances, besides small amounts of an essential oil and a sugar yielding *d*-phenylglucosazone, were as follows: hentriacontane, $C_{31}H_{64}$; a phytosterol, $C_{27}H_{46}O$; palmitic, stearic, cerotic, oleic, and linolic acids; and ipuranol, $C_{23}H_{38}O_2(OH)_2$. From the root there were obtained, furthermore, a new monohydric alcohol, *withaniol*, $C_{25}H_{33}O_4{\cdot}OH$, decomposing at 305°, and having $[\alpha]_D$ +91·2°, and an amorphous alkaloidal principle, which, on treatment with alkali hydroxides, yielded a crystalline *base*, $C_{12}H_{16}N_2$ (m. p. 116°). The leaves and stems yielded the following new compounds: a monohydric alcohol, *somnirol*, $C_{32}H_{43}O_6{\cdot}OH$, decomposing at 205°, and having $[\alpha]_D$ +34·8°; a dihydric alcohol, *somnitol*, $C_{33}H_{44}O_5(OH)_2$, decomposing at about 250°, and having $[\alpha]_D$ +21·2°; and an acidic, hydrolytic product, *withanic acid*, $C_{29}H_{45}O_6{\cdot}CO_2H$ (m. p. 226°), the *methyl* ester of which decomposed at 255°.

Withania somnifera, unlike some other solanaceous plants, contains no mydriatic alkaloid, and physiological tests, conducted on a dog, failed to confirm the sedative or hypnotic properties attributed to it.

***56. "The carbohydrate constituents of Pára rubber: separation of *l*-methylinositol." (Preliminary note.) By Samuel Shrowder Pickles and Bernard Wyndham Whitfeild.**

During the examination of various specimens of smoked plantation rubber from the Malay Peninsula, the presence of a crystalline, sugar-like substance, melting at 191—192°, was detected in all cases. The amount of this constituent present in the different specimens varied considerably, being in some cases as high as 2·5 per cent. On analysis it gave the following results:

(1) 0·1674 gave 0·2648 CO_2 and 0·1035 H_2O. C = 43·1; H = 6·9.
(2) 0·2150 „ 0·3385 CO_2 „ 0·1350 H_2O. C = 42·9; H = 7·0.
0·2225 „ 0·2615 AgI. OMe = 15·5.

$C_6H_{11}O_5 \cdot OMe$ requires C = 43·3; H = 7·2; OMe = 15·96 per cent.

This substance is lævorotatory; a 10 per cent. aqueous solution gave $\alpha - 8°$, whence $[\alpha]_D - 80°$. It does not reduce Fehling's solution, and is scarcely affected by prolonged boiling with moderately concentrated sulphuric or hydrochloric acids. Hydriodic acid decomposes it with the formation of methyl iodide and *l*-inositol (m. p. 237°).

The compound is thus *l*-methylinositol, and is identical with that isolated from quebracho bark by Tanret (*Compt. rend.*, 1889, **109**, 908), and designated quebrachite. Its presence has also been previously observed in the aqueous portion of the latex of *Hevea brasiliensis* which remains after the coagulation of the rubber, by de Jong (*Rec. trav. chim.*, 1906, **25**, 48).

The authors have also confirmed this observation by the examination of specimens of the latex of *Hevea brasiliensis* from the Botanic Gardens at Singapore, and have found that this substance (*l*-methylinositol) constitutes the greater portion of the carbohydrate constituents of the latex. They also find that the occurrence of *l*-methylinositol (quebrachitol) is quite general in rubbers from *Hevea brasiliensis*, and have isolated it, not only from those of Asiatic origin, but also from "fine hard Pára" rubber from South America.

DISCUSSION.

Dr. PICKLES stated, in reply to questions, that, although probably the *l*-methylinositol in the latex was not directly connected with the formation of rubber, its presence was worthy of note, and there was the possibility that under the influence of enzymes it might be converted into products which could be utilised by the plant for the construction of the rubber hydrocarbon.

57. "Potassium cupricarbonates." By S. U. Pickering.

Previous work on other cupri-compounds indicate the possibility of there being eight, or even more, compounds of potassium carbonate with copper carbonate; nine have been isolated. Potassio-cupric carbonate exists in a hydrated and anhydrous condition, the latter, however, not being the compound of the same empirical formula isolated by Reynolds (*Trans.*, 1898, **73**, 263). The β-cupricarbonate, $(CO_3)_2K_2Cu^{IV},H_2O$, forms a gelatinous precipitate; and a compound which appears to be derived from it by abstraction of the elements of water (indirectly) has been obtained. The other five compounds, which are all crystalline, are α-cupricarbonates (that is, containing the $Cu^{IV}CO_3$ group), with the formulæ: $[(CO_3)_3K_2Cu_2^{IV},Cu_2(CO_3)_2]$, $[(CO_3)_4K_4Cu_2^{IV},CuK_2(CO_3)_2]$, and $[(CO_3)_4K_4Cu_2^{IV},Cu_2K_2(CO_3)_3]$, with two other members derived from the last by the substitution of Cu for K_2.

Three of these substances have the empirical formula $CuK_2(CO_3)_2$, but are well distinguished from each other by their physical and chemical properties, and by their heats of formation. Several other organic acids apparently form cupri-compounds analogous to the cupricarbonates.

58. "Synthesis of dipeptides of α-aminolauric acid with glycine, alanine, valine, leucine, and asparagine." By Arthur Hopwood and Charles Weizmann.

In view of the possible presence of peptides of α-aminolauric acid with amino-acids in the proteins occurring in certain plants, the authors have prepared the following derivatives:

α-Bromolauryl chloride, $C_{11}H_{22}Br{\cdot}COCl$, is obtained by heating α-bromolauric acid with phosphorus pentachloride. It is a colourless liquid, boiling at 150°/10 mm.

α-Bromolaurylglycine, $C_{11}H_{22}Br{\cdot}CO{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, is prepared by the interaction of α-bromolauryl chloride and glycine in presence of sodium hydroxide. It forms colourless, rhombic plates, melting at 117·0° to 118·5°, which are only sparingly soluble in water, but readily so in alcohol, ether, benzene, toluene, or alkalis.

α-Aminolaurylglycine, $NH_2{\cdot}C_{11}H_{22}{\cdot}CO{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, is formed by heating α-bromolaurylglycine with concentrated aqueous ammonia. It crystallises in prismatic needles, which sinter at 207°, and melt and decompose at 214·0—214·5°. It is nearly insoluble in water, sparingly soluble in alcohol, but readily so in alkalis or acids. Like the proteins, it yields a white, amorphous precipitate with phosphotungstic acid, and is hydrolysed by enzymes.

Somewhat similar bromo-compounds are obtained by the condensation of α-bromolauryl chloride with alanine, valine, leucine, and asparagine, and these, on treatment with ammonia, yield the corresponding dipeptides.

59. "The occlusion of hydrogen by the palladium-gold alloys." By Arthur John Berry.

Determinations have been made of the quantities of hydrogen occluded by the palladium-gold alloys when charged electrolytically with hydrogen. With alloys in which the concentration of palladium exceeded about 25 per cent., the occluding power was found to be a simple function of the concentration of that metal. Alloys more dilute in respect to palladium do not possess the property of occluding any hydrogen.

60. "Synthesis of *dl*-3 : 4-dihydroxyphenylalanine." By Casimir Funk.

With the view of testing whether any relationship exists between tyrosine and adrenaline, a catechol derivative corresponding with tyrosine was prepared. The synthesis of this *dl*-3 : 4-*dihydroxyphenylalanine* was carried out according to the method originally suggested by Erlenmeyer. The cyclic carbonic ester of catecholaldehyde was condensed with hippuric acid, and the resulting azlactone saponified with sodium hydroxide; the substituted cinnamic acid which was formed was reduced with sodium amalgam, and the benzoyl group eliminated by boiling with hydrochloric acid. The amino-acid obtained gave all the ordinary chemical reactions of adrenaline. Experiments are now being conducted with the view of ascertaining the nature of the changes which this substance undergoes in the animal body.

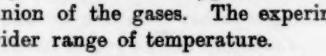
61. "The interaction of chlorine and carbon monoxide." (Preliminary note.) By David Leonard Chapman and Frank Houghton Gee.

It has been shown that the photochemical interaction of carbon monoxide and chlorine is inhibited by the same substances as those which prevent or retard the action between chlorine and hydrogen in light. Nitrosyl chloride almost prevents the union of carbon monoxide and chlorine when the mixed gases are exposed to a very intense light, and since it is not decomposed its action continues for an indefinite period.

Experiments have also been performed at higher temperatures; the gases combine slowly at 350°, and it is significant that light has no—or, at most, an inappreciable—influence on the rate of combination at this temperature. The inhibitors which have been tried, namely, nitrosyl chloride and oxygen, are also without effect on the pyrogenic union of the gases. The experiments are being continued over a wider range of temperature.

62. "**Experiments on the synthesis of the terpenes. Part XVI. Resolution of *dl*-1-methyl-Δ³-*cyclo*hexene-3-carboxylic acid. Synthesis of the *d*- and *l*-modification of Δ³-*m*-menthenol(8) and Δ³:⁸⁽⁹⁾-*m*-menthadiene.**" **By Bernard Dunstan Wilkinson Luff and William Henry Perkin, jun.**

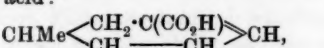
The authors have succeeded in resolving *dl*-1-methyl-Δ³-*cyclo*hexene-3-carboxylic acid:



by the use of brucine and *l*-menthylamine, whereby the synthesis of the *d*- and *l*-modification of Δ³-*m*-menthenol(8) and Δ³:⁸⁽⁹⁾-*m*-menthadiene has been made possible.

63. "**Experiments on the synthesis of the terpenes. Part XVI. *d*-Δ³-*p*-menthenol(8) and d-Δ³:⁸⁽⁹⁾-*p*-menthadiene.**" **By Tsan Quo Chou and William Henry Perkin, jun.**

The preparation of *d*-1-methyl-Δ³-*cyclo*hexene-4-carboxylic acid,



from *d*-1-methyl*cyclo*hexan-3-one was described. It has $[\alpha]_D$ +150·1°, and yields the *d*-modification of Δ³-p-*menthenol*(8) and Δ³:⁸⁽⁹⁾-p-*menthadiene* when its ester is treated with magnesium methyl iodide and subsequently with dehydrating agents.

64. "**Some derivatives of *o*-veratraldehyde.**" (**Preliminary note.**) **By William Henry Perkin, jun., Walter Morrell Roberts, and Robert Robinson.**

o-Veratraldehyde, $(MeO)_2C_6H_3\cdot CHO$[MeO : MeO : CHO = 1 : 2 : 3] is a substance of importance in connexion with the synthesis of alkaloids, and particularly of berberine. The authors have therefore prepared some of its more interesting derivatives.

o-Veratric acid, $C_6H_3(OMe)_2\cdot CO_2H$, is obtained on oxidation of the aldehyde in acetone solution with potassium permanganate. It is moderately readily soluble in hot water, and crystallises in needles, melting at 122°. Its methyl ester melts at 47°, and has

also been prepared by Fritsch (*Annalen*, 1898, **301**, 356) by the methylation of guaiacolcarboxylic acid.

1 : 3-*Diketo*-2-o-*veratrylidenehydrindene*,

$$C_6H_3(OMe)_2\cdot CH{:}C\begin{matrix}CO\\CO\end{matrix}>C_6H_4,$$

is prepared by heating together the aldehyde and diketohydrindene. It crystallises from alcohol in bright yellow needles, melting at 160°.

5 : 6-*Dimethoxy*-2-o-*veratrylidene*-1-*hydrindone*,

$$C_6H_3(OMe)_2\cdot CH{:}C\begin{matrix}CO\\CH_2\end{matrix}>C_6H_2(OMe)_2.$$

is obtained when a solution of equimolecular proportions of *o*-veratraldehyde and 5 : 6-dimethoxy-1-hydrindone in ethyl alcohol is treated with two or three drops of concentrated potassium hydroxide. The substance crystallises from alcohol in pale yellow needles, melting at 186°. When it is dissolved in sulphuric acid, an orange-coloured solution is obtained, which contains the anhydrosulphate of a pyranol base produced with loss of methyl alcohol.

2 : 3-*Dimethoxycinnamic Acid*, $C_6H_3(OMe)_2\cdot CH{:}CH\cdot CO_2H$.—This substance is best prepared by hydrolysis of the corresponding ethyl ester obtained by the condensation of *o*-veratraldehyde with ethyl acetate by means of sodium.

The acid separates from ethyl acetate in long, colourless needles, and melts at 180°. It shows the usual properties of a cinnamic acid, and is readily reduced by sodium amalgam, yielding 2 : 3-*dimethoxy-β-phenylpropionic acid*, $C_6H_3(MeO)_2\cdot CH_2\cdot CH_2\cdot CO_2H$, which crystallises from a mixture of benzene and light petroleum in prisms, melting at 69°.

4 : 5-*Dimethoxy*-1-*hydrindone*, $C_6H_2(OMe)_2\begin{matrix}CO\\CH_2\end{matrix}>CH_2$, is produced in good yield when dimethoxyphenylpropionic acid is treated with phosphoric oxide in boiling benzene solution. It crystallises from ether or light petroleum in small, pale yellow plates, melting at 82°.

4 : 5-*Dimethoxy*-2-o-*anisylidene*-1-*hydrindone*,

$$C_6H_2(OMe)_2\begin{matrix}CO\\CH_2\end{matrix}>C{:}CH\cdot C_6H_4\cdot OMe,$$

prepared by heating equimolecular proportions of anisaldehyde and 4 : 5-dimethoxy-1-hydrindone with potassium hydroxide in warm alcoholic solution, crystallises from acetic acid or ethyl alcohol in long, feathery needles, melting at 153—154°.

2-iso*Nitroso*-4 : 5-*dimethoxy*-1-*hydrindone*,

$$C_6H_2(OMe)_2\begin{matrix}CO\\CH_2\end{matrix}>C{:}N\cdot OH,$$

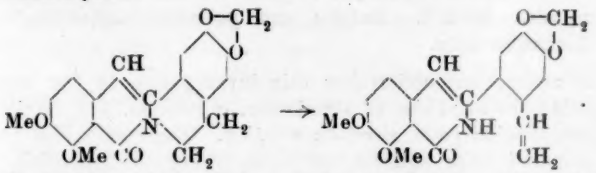
is prepared by the action of amyl nitrite and a few drops of hydro-

chloric acid at 50° on the hydrindone dissolved in ethyl alcohol. It forms pale yellow needles, which melt and decompose at 244°, and is soluble in alkalis. On oxidation with potassium permanganate in alkaline solution, a good yield of hemipinic acid is obtained.

65. "*iso*Oxyberberine." (Preliminary note.) By Norman Bland, William Henry Perkin, jun., and Robert Robinson.

When oxyberberine is heated in an autoclave at 130° for five hours with dilute hydrochloric acid, it is converted into an isomeride to which the name iso*oxyberberine* is given.

The new substance is probably produced in accordance with the following scheme, which represents *iso*oxyberberine as a derivative of *iso*carbostyril:



*iso*Oxyberberine is much less soluble in glacial acetic acid than is oxyberberine, and crystallises from this solvent in pale, greyish-yellow microscopic needles, melting at 245°.

It gives a red azo-colouring matter when treated with alkali and diazotised sulphanilic acid, and a purplish-red colour with aqueous ferric chloride. It does not appear to have basic properties.

*Acetyl*iso*oxyberberine*, $C_{20}H_{16}O_5N(CO\cdot CH_3)$, is prepared by boiling *iso*oxyberberine with acetic anhydride and sodium acetate. It crystallises from acetic acid in needles, and melts at 261°.

*Nitroso*iso*oxyberberine*, $NO\cdot C_{20}H_{16}O_5N$, is prepared by shaking *iso*oxyberberine with a solution of amyl nitrite in glacial acetic acid for five hours in the cold. The compound is very sparingly soluble in most organic solvents, but can be recrystallised from hot pyridine, and occurs in highly characteristic, golden-brown, microscopic needles, melting at 263—265°. These and other derivatives of this substance are in process of detailed investigation.

66. "The application of viscometry to the measurement of rate of reaction." By Albert Ernest Dunstan and Albert George Mussell.

The authors have measured the viscosity of a variety of compounds undergoing chemical changes. They find that, in general,

the viscosity changes with the lapse of time, in such a way that the total viscosity change is proportional to the amount of substance transformed. They consider that a useful method for the measurement of the velocity of reaction may be based on this observation. Accordingly, experiments have been made in which the rates of the following transmutations are measured:

Freshly distilled acetoacetic ester $\longrightarrow$ equilibrium mixture; aniline and ammonium thiocyanate $\longrightarrow$ phenylthiocarbamide; ammonium cyanate $\longrightarrow$ carbamide; ammonium thiocyanate $\longrightarrow$ thiocarbamide; acetic anhydride and water $\longrightarrow$ acetic acid; benzoyl chloride and water $\longrightarrow$ benzoic acid.

67. "The action of hydrogen sulphide on the alkyloxides of the metals. Part I. Sodium and potassium ethoxides." By Alexander Rule.

The author has undertaken this investigation in the hope of preparing the sulphides of aluminium, chromium, and ferric iron by precipitation from alcoholic solution. These sulphides cannot be prepared from aqueous solutions, owing to hydrolysis, and when obtained in the dry way they are always impure. As no record of the action of hydrogen sulphide on the alkyloxides of sodium or potassium could be discovered, this action was first investigated, and found to result in the formation of the pure anhydrous hydrosulphides of these metals, the compounds being precipitated from alcoholic solution on the addition of ether or benzene.

The reaction provides a very simple and rapid method for the preparation of the anhydrous hydrosulphides, and the yields are practically quantitative.

The behaviour of hydrogen sulphide towards the solid ethoxides of sodium and potassium was also investigated. Reaction was found to take place at the ordinary temperature, and resulted in the formation of the hydrosulphides of the metals and evolution of alcohol.

68. "Simple method of decomposing refractory tin ores." By Herbert Yabsley Loram.

The mineral (2 grams, or more if desired), crushed to a sixty-hole powder, is fused for about an hour in a covered silver crucible at a temperature well below its melting point, with about

six or seven times its weight of potassium hydroxide, to which is added potassium cyanide equal to the weight of tin ore taken.

The mass, on cooling, is extracted with water, when the whole will dissolve in dilute hydrochloric acid, and after boiling to destroy any cyanide still remaining, the tin can be estimated by any of the usual methods.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Carré, *P.* Hydrocarbures, alcools et éthers de la série grasse. pp. 410. Paris 1911. (*Recd.* 15/2/11.)
From the Publishers: M. O. Doin et Fils.

Harden, *Arthur.* Alcoholic fermentation. pp. ix + 128. London 1911. (*Recd.* 21/2/11.) From the Author.

Hilditch, *Thomas Percy.* A concise history of chemistry. pp. ix + 263. London 1911. (*Recd.* 1/3/11.)
From the Publishers: Messrs. Methuen & Co.

Senter, *George.* Outlines of physical chemistry. 2nd edition. pp. xvii + 387. ill. London 1911. (*Recd.* 1/3/11.)
From the Publishers: Messrs. Methuen & Co.

II. *By Purchase.*

Castell-Evans, *John.* Physico-chemical tables. Vol. II. Physical and analytical chemistry. pp. xiv + 549 to 1235. London 1911. (*Recd.* 23/2/11.)

Seeligmann, *Franz,* and **Zieke,** *Emil.* Handbuch der Lack- und Firnis-Industrie. pp. xvi + 953. ill. Berlin 1910. (*Recd.* 22/2/11.)

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held on Thursday, March 23rd, 1911, at 5 p.m., when the President will deliver his address, entitled, "On the Initiation and Propagation of Explosions."

ERRATA.

1911. P. 46, alter title of paper No. 52 to:

"The optical properties of compounds containing an asymmetric 'quaternary' carbon atom. Part I. The synthesis of β-phenyl-β-methylvaleric acid and of *as*-methylethylsuccinic acid."

P. 46, line 13 from below, *read* "Compounds containing an asymmetric 'quaternary' carbon atom might be."

At the next Ordinary Scientific Meeting on Thursday, March 16th, 1911, at 8.30 p.m., the following papers will be communicated:

"Apparatus for the maintenance of constant pressures above and below the atmospheric pressure: application to fractional distillation." By J. Wade.

"Influence of water on the boiling point of ethyl alcohol at pressures above and below the atmospheric pressure." By J. Wade and R. W. Merriman.

"The interaction of aromatic disulphides with sulphuric acid." By W. G. Prescott and S. Smiles.

"The absorption spectra of permanganates in certain solvents." By T. R. Merton.

"The action of carbon dioxide in the bleaching process." By S. H. Higgins.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 30/3/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 384.

Thursday, March 16th, 1911, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the death of Geheimrath Professor Dr. Jacobus Heinricus van't Hoff (elected an Honorary and Foreign Member of the Society on February 2nd, 1888), who died on March 1st last. He stated that the following telegram had been sent to Frau van't Hoff in the name of the Society:

"The President, Officers, and Council of the Chemical Society deeply mourn the loss of their distinguished Honorary and Foreign Member, Professor Doctor J. H. van't Hoff."

Messrs. Harold J. Page and F. Challenger were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Ernest Carr Bennison, 4, Sir John's Road, Selly Park, Birmingham.

Richard Charles Bowden, B.Sc., 21, Rokeby Avenue, Redland, Bristol.

Algernon John Elkington, 26, Rye Hill Park, S.E.

Alfred Walker Empson, 174, Dhunumtollah Street, Calcutta.

Idris Larkby Owen, M.Sc., 101, Floyer Road, Small Heath, Birmingham.

Robert Robison, Ph.D., B.Sc., 227, Woodborough Road, Nottingham.

Certificates have been authorised by the Council for presentation to Ballot under Bye-law I(3) in favour of Messrs.:

John Ernest Roux Adendorff, Randfontein, Transvaal.
Atulchandra Datta, M.A., Bag Mozaffar Khan, Agra.
Thomas Grantham Giddy, High Street, Newcastle, N.S.W.

A proposal having been made by some of the old students of Robert Wilhelm Bunsen to send a wreath to place at the foot of his statue in Heidelberg on the occasion of the 100th anniversary of his birth (March 31st), the President stated that the Council had authorised him to sign, on behalf of the Chemical Society, the inscription attached to the wreath.

The PRESIDENT read a letter addressed to the Council by Sir Edward Thorpe, stating that a committee had been formed with the object of raising a fund for the erection of a memorial to Joseph Priestley in his native town of Birstall, Yorkshire.

Subscriptions to the fund should be sent to Mr. W. Bagshaw, at Moorfields, Birkenshaw, Leeds.

Of the following papers, those marked * were read:

***69. "Apparatus for the maintenance of constant pressures above and below the atmospheric pressure. Application to fractional distillation." By John Wade and Richard William Merriman.**

For pressures below the atmospheric pressure, air is exhausted continuously from the system by an ordinary water-pump. For pressures above the atmospheric pressure, air or other gas is forced in continuously by an automatic compressor, actuated by falling mercury. The pressure is kept constant by a regulator or compensator consisting of an open syphon manometer, which allows air or other gas to escape from, or enter, the system as soon as the desired excess or diminution of pressure is exceeded.

Various devices were also described in connexion with fractional distillation, more especially for changing the receiver without disturbing the pressure.

DISCUSSION.

The PRESIDENT recalled the simple method used by Professor F. D. Brown twenty-five years ago for distillations under reduced pressure. The apparatus devised by the authors was obviously an instrument of great delicacy. He also congratulated the authors on having devised a convenient apparatus for keeping up a high-

pressure supply of gases in which the pressure was automatically regulated. He would have found such an apparatus of great use in his work on the ignition-points of gases at varying pressures.

Dr. FORSTER inquired as to the experience of the authors in connexion with bumping. At the lower pressures referred to by Dr. Wade, bumping would present much inconvenience unless checked by admission of air, and as it was the speaker's experience that under very low pressures liquids distilled without bumping, he was interested to know whether this phenomenon accompanied distillation under pressures much exceeding one atmosphere.

Dr. WADE said that he and his colleague had experienced no difficulty with bumping; the liquids so far investigated boiled under pressures above atmospheric with perfect steadiness. The only difficulty encountered under high pressures was the great increase in the amount of air dissolved in the distillate, which escaped with considerable energy on releasing the pressure. He thought that Dr. Forster's suggestion of distilling volatile liquids under increased pressure in order to avoid bumping was eminently practicable.

***70. "The influence of water on the boiling point of ethyl alcohol at pressures above and below the atmospheric pressure." By John Wade and Richard William Merriman.**

The ratio of water to alcohol in the binary mixture of minimum boiling point, isolated by Young and Fortey (*Trans.*, 1902, **81**, 1717) by systematic fractional distillation, is increased by raising, and diminished by lowering, the pressure under which the fractionation is effected. At pressures below about 80 mm., corresponding with temperatures below about 25°, ethyl alcohol and water cease to form a binary mixture. Under these conditions, anhydrous alcohol is the most volatile phase present in ordinary spirit, and may be separated from the water to any desired extent by systematic fractional distillation. For the same reason, although alcohol, contrary to general belief, is not appreciably hygroscopic, the percentage of water in moist alcohol is slowly increased by exposing it to air, or even by passing dry air through it.

***71. "The interaction of aromatic disulphides and sulphuric acid." By William George Prescott and Samuel Smiles.**

When the solutions of certain disulphides in sulphuric acid are mixed with simple aromatic compounds, sulphurous acid is evolved, and unsymmetrical monosulphides are formed. Reasons were adduced in support of the hypothesis that preliminary fission of the

dithio-system is effected by the acid, the sulphoxylic acid and mercaptan being produced:

$$\text{i.}\quad \mathrm{Ar{\cdot}S{\cdot}S{\cdot}Ar} + \mathrm{H_2O} \longrightarrow \mathrm{Ar{\cdot}S{\cdot}OH} + \mathrm{ArSH}.$$

The first-named substance then yields the unsymmetrical monosulphide by condensation with the aromatic compound:

$$\text{ii.}\quad \mathrm{Ar{\cdot}S{\cdot}OH} + \mathrm{HAr'} = \mathrm{Ar{\cdot}S{\cdot}Ar'} + \mathrm{H_2O},$$

whilst the mercaptan is oxidised to the disulphide (Stenhouse, *Annalen*, 1869, **149**, 250), which is then available for renewed decomposition. It was further shown that the character of this reaction (i) strongly suggests that it is reversible.

This hypothesis explains and correlates in a simple manner all the known reactions of disulphides and mercaptans in sulphuric acid.

***72. "The absorption spectra of permanganates in certain solvents." By Thomas Ralph Merton.**

Measurements have been made of the three least refrangible bands in the absorption spectra of potassium, calcium, barium, and zinc permanganates, in water, acetone, acetic anhydride, acetonitrile, methyl acetate, pyridine, methyl alcohol, ethyl alcohol, and ethylene glycol, except in those cases where the reaction between the salt and the solvent is too rapid for measurements to be made; the positions of the absorption maxima vary in different solvents, although the general character of the absorption remains the same.

Discussion.

Mr. Merton stated, in reply to a question, that no steps had been taken to secure large crystals of the solid solution, as this was not necessary for the purpose of observing the absorption spectrum.

***73. "The resolution of asymmetrical derivatives of phosphoric acid." By Frederic Stanley Kipping and Frederick Challenger.**

This work is a continuation of that published by Luff and Kipping (*Trans.*, 1909, **95**, 1993), and deals with the preparation and resolution of dl-*phenyl-β-naphthyl hydrogen phosphate*,

$$\mathrm{PO(OPh)(O{\cdot}C_{10}H_7){\cdot}OH}.$$

Attempts to resolve this acid by the fractional crystallisation of the salts which it forms with optically active bases were unsuccessful, but the l-*menthylamide*, $\mathrm{PO(OPh)(O{\cdot}C_{10}H_7){\cdot}NH{\cdot}C_{10}H_{19}}$, was easily separated into its stereochemically isomeric components.

Discussion.

Professor Frankland asked what was the order of the difference in rotation of the two isomeric menthylamides. He suggested that the hydrolysis of the menthylamides might probably have been effected if hydrochloric acid instead of potash had been used. He also thought that the resolution of the acid might have been more advantageously attempted by adopting McKenzie's method of partial esterification with menthol or some other optically active alcohol, and that similarly the acid chloride might have been made to interact with an insufficient quantity of an optically active primary or secondary amine.

Dr. Lowry agreed with the authors that the isomeric amides could not be

$$(3\text{ and }4)O\!\!>\!\!P\!<\!\!\begin{matrix}C_6H_5(1)\\C_7H_7(2)\end{matrix} \quad\text{and}\quad (3)HO\!\!>\!\!P\!<\!\!\begin{matrix}C_6H_5(1)\\C_7H_7(2)\end{matrix}$$
$$(5)NHX \qquad\qquad (4\text{ and }5)NX$$

since such compounds would certainly be interconvertible. The production by a reversible action of a mere trace of one of them would, further, be sufficient to bring about the inversion or racemisation of the *d*- and *l*-forms of the other; the double bond of the first compound could be broken in such a way as to produce the OH in position 3 or 4, whilst the breaking of the double bond of the second compound could give rise to NHX in position 4 or 5; the linkings 3, 4, and 5 would, therefore, be interchangeable, and optical activity could not be expected to persist. In the case of the acids, which had resisted all attempts at resolution, it was probably impossible to isolate *d*- and *l*-forms; the addition and removal of water afforded a mechanism for interchanging the

$$O\!\!>\!\!P\!<\!\!\begin{matrix}C_6H_5\\C_7H_7\end{matrix} \rightleftarrows HO\!-\!P\!<\!\!\begin{matrix}C_6H_5\\C_7H_7\end{matrix} \rightleftarrows HO\!\!>\!\!P\!<\!\!\begin{matrix}C_6H_5\\C_7H_7\end{matrix}$$
$$HO \qquad\qquad HO \qquad\qquad O$$
$$d\text{-}(?). \qquad\qquad l\text{-}(?).$$

linkings in ways that would almost certainly result in optical inversion and consequent racemisation.

74. "The action of carbon dioxide in the bleaching process." By Sydney Herbert Higgins.

On adding calcium chloride to lime-water, the rate of attraction of carbon dioxide from the air by the lime-water is increased, and this fact probably accounts for the observation that the addition of calcium chloride to bleaching powder solution increases the bleaching efficiency of that solution. On exposing bleaching powder

solution to air, the free lime contained in the solution is deposited as calcium carbonate, and then the carbon dioxide of the air acts on the other calcium salts present in solution. It is the latter action that causes the exposed bleaching powder solution to have a high bleaching efficiency. Common salt added to sodium hypochlorite solution increases its bleaching activity, and this is also true of other neutral salts of sodium; solutions containing equivalent proportions of these salts have approximately the same effect in increasing the bleaching activity. Moreover, equivalent proportions of common salt and of calcium chloride have approximately the same effect in increasing the activity of bleaching powder solutions. These effects are probably due to the so-called "neutral salt action" and to the increased attraction of the carbon dioxide of the air by the neutral salt solutions. The results of the experiments and other facts (Higgins, *J. Soc. Chem. Ind.*, 1911, **30**, 185) do not agree with the conclusions of Taylor (*Trans.*, 1910, **97**, 2541). The author represents the action of carbon dioxide on bleaching powder by the following equations:

(1) $Ca(OCl)_2 + CO_2 + H_2O = CaCO_3 + 2HOCl.$

(2) $2HOCl + CaCl_2 + CO_2 = CaCO_3 + 2Cl_2 + H_2O.$

The action represented by equation (2) is found to be reversible, and thus accounts for Taylor's (*loc. cit.*) and the author's results. In bleaching with bleaching-powder solution, hypochlorous acid enters into the bleaching action, and as much nascent chlorine as is supplied by the reaction represented in equation (2), the carbon dioxide being supplied by the air.

75. "The relation between the absorption spectra of metallic ions and their valency." (Preliminary note.) By Cecil Reginald Crymble.

A study is being made of the absorption of light by aqueous solutions of the salts of metals.

A metallic ion is regarded as being "non-absorptive" when 10 mm. of a normal solution of its salt, or a length of solution containing an equivalent amount of the metal, transmits the spectrum of the iron arc up to λ 2300.

In photographing the absorption spectra, solutions of salts of the metals, such as chlorides or sulphates, have been employed, as in these cases the acidic radicle is non-absorptive, and the absorption, if any, must be due to the metal.

The metals that have been examined up to the present may be grouped into two classes, namely, "non-absorptive" and "absorptive."

The first class, "non-absorptive," contains the following metals:

Li, Na, K, Gl, Mg, Zn, Cd, Ba, Al, Th.

The second class, "absorptive," contains:

Metals giving colourless solutions: Hg, Tl, Sn, Pb, Sb, Bi.

Metals giving coloured solutions: Cu, Ce, Mn, Fe.

In addition to the metals giving coloured ions, the following metals give coloured solutions, and may be included under that head: Au, Cr. U, Co, Pt, Ti, V.

When regarded from the point of view of valency, it will be observed that the first class comprises the metals of constant valency, that is, the metals which are incapable of giving two series of salts, and that the second class comprises the metals of varying valency, that is, those metals which give two or more series of salts—the valency of a metal being determined by the fluorine or chlorine compounds which it forms.

The metals which give absorptive ions may be divided into those showing selective absorption, such as:

Cu, Ce, Cr, Mn, Fe, Co,

and those showing general absorption only, like:

Tl, Sn, Pb, Sb.

The former give two series of salts in which the metal, in passing from the "ous" to the "ic" form, increases its valency by one; for example, iron gives the chlorides $FeCl_2$ and $FeCl_3$.

In the latter group the metal, when changing from the state of low valency to that of high valency, increases its valency by two, for example, tin gives the chlorides $SnCl_2$ and $SnCl_4$.

It has not yet been determined, however, whether this relation is present in all cases.

The research is being continued with a view to observing the difference in absorptive power between the two forms of the same metal where the metal gives two series of salts, and to investigating the absorption spectra of the metalloids and non-metals. An attempt is also being made to trace a relationship between the absorption spectra of the metallic ion and the position of the metal in the electro-potential series.

76. "The element Cu | Cu_2O alkali | H_2 at 0°."

By Arthur John Allmand.

The electrode system Cu|Cu_2O – *N*-NaOH was measured at 0°, and by combining with it the calculated value for the electrode H_2|*N*-NaOH, the value of the *E.M.F.* of the cell Cu|Cu_2O alkali|H_2 at 0° was obtained. It is one centivolt higher than the value calculated by Nernst's theorem.

77. "A standard electrode with alkaline electrolyte: Hg | HgO alkali." By Frederick George Donnan and Arthur John Allmand.

The authors have extended previous work carried out with this system, and have been able closely to define three standard electrodes at 25° and 0°, namely:

Hg|HgO *N*-KOH.
Hg|HgO *N*-NaOH.
Hg|HgO *N*/10-NaOH.

The mean errors of the values given vary between ±0·00002 and ±0·00011 volt.

78. "The volatile constituents of coal. Part II." By Maurice John Burgess and Richard Vernon Wheeler.

In continuation of their previous work, the authors have studied the action of heat on coal, paying particular attention to the composition of the gases evolved during successive stages of distillation at a uniform temperature. They find that coal contains two types of compounds of different degrees of ease of decomposition. The one, the more unstable, yields the paraffin hydrocarbons and no hydrogen; the other, decomposed with greater difficulty, yields hydrogen alone (or, possibly, hydrogen and the oxides of carbon) as its gaseous decomposition product. The authors consider that the difference between one coal and another is determined mainly by the proportions in which these two types of compounds exist; and that the true "coal substance," apart from the traces of sulphur compounds and other substances which mask its character, is compounded of the two types that behave so differently under the action of heat. It has been shown that there is considerable justification in assuming that one type of compound in coal, the vegetable origin of which is undoubted, is a degradation product of cellulose. The authors identify the "hydrogen-yielding constituents" with this type, and regard the "paraffin-yielding constituents" as being most probably derived from the resins and gums originally contained in the sap of the coal plants. They suggest that the substance which P. P. Bedson (*J. Soc. Chem. Ind.*, 1908, **27**, 147) has shown to be extracted in considerable quantity from coal by the solvent action of pyridine is compounded of the "paraffin-yielding constituents"; and they therefore regard coal as a conglomerate of which the degradation products of cellulose form the base, and the changed resins and gums of the coal plants the cement.

79. **"The absorption spectra of chlorobenzene and bromobenzene as vapours, as liquids, and in solution."** **By John Edward Purvis.**

The chief results of the investigation are: (1) that the vapours of chloro- and bromo-benzene exhibit a considerable number of narrow bands which can be divided into groups; (2) that alcoholic solutions exhibit seven diffuse bands which are comparable in appearance, and only differ in their relative positions; (3) that very thin films exhibit seven diffuse bands which are comparable with each other and with the bands of the solutions, and only differ in their relative positions.

80. **"Orthophosphoric acid as a dehydrating catalytic agent. Part I. The condensation of acetone in presence of phosphoric acid."** **By Pañchānan Neogi.**

The author finds that in presence of ortho- and meta-phosphoric acids, acetone condenses to form mesitylene, mesityl oxide, phorone, and xylitone. A given quantity of the acid has repeatedly been used to convert fresh quantities of acetone into its condensation products.

81. **"Trialkylammonium nitrites and nitrites of the bases of the pyridine and quinoline series. Part I."** **By Pañchānan Neogi.**

Triethylammonium nitrite and *pyridinium nitrite* have been prepared by the interaction of silver nitrite and the hydrochlorides of the bases. The former exists both in monohydrated and anhydrous conditions, and can be sublimed unchanged under the ordinary, or under diminished, pressure. The latter is anhydrous, and is unstable.

82. **"Nitrites of the alkylammonium bases: ethylammonium nitrite, dimethylammonium nitrite, and trimethylammonium nitrite."** **(Preliminary note.)** **By Prafulla Chandra Rây and Jitendra Nath Rakshit.**

In continuation of their previous work on methylammonium nitrite, the authors have succeeded in preparing the above members of the series by the same method, namely, interaction of silver nitrite and the corresponding chlorides of the alkylammonium bases and evaporation of the filtrate in a vacuum over sulphuric acid. Double decomposition between mercuric nitrite and the free bases in aqueous solution also furnishes the above products. It

is worthy of note that whilst methylammonium nitrite is a yellowish-green, crystalline substance, its homologue, *ethylammonium nitrite*, $NH_3Et{\cdot}NO_2$, is a viscid liquid of a pale brownish-yellow colour. *Dimethylammonium nitrite*, $NH_2Me_2{\cdot}NO_2$, is a limpid, pale yellow liquid. *Trimethylammonium nitrite*, $NHMe_3{\cdot}NO_2$, on the other hand, is a pale green, crystalline solid.

83. "Isomeric monothiophosphates."
By William Gidley Emmett and Humphrey Owen Jones.

The isomeric α- and β-methyl monothiophosphates, $PS(OMe)_3$ and $PO(OMe)_2{\cdot}SMe$, have been examined in the hope that on saponification they would yield isomeric sodium monothiophosphates. Two different sodium dimethyl monothiophosphates are formed by the action of sodium methoxide on the esters, and a disodium methyl α-thiophosphate was obtained by saponification of the α-ester with sodium hydrosulphide, but no isomeric trisodium thiophosphates have been isolated.

The interactions of the esters and their derivatives with metallic salts have been examined.

Both α- and β-esters react with methyl iodide to give trimethylsulphonium iodide and a methyl phosphate.

84. "The absorption spectra of chlorobenzene, the dichlorobenzenes, and the chlorotoluenes." By Edward Charles Cyril Baly.

The absorption spectra of chlorobenzene, the three dichlorobenzenes, and the chlorotoluenes have been observed with more efficient apparatus than was possible in the earlier work (*Trans.*, 1905, **87**, 1332, 1355). Some new absorption bands have been detected.

85. "Chemical constitution and hypnotic action. Acid amides and products of the condensation of malonamides and malonic esters." By Frederic George Percy Remfry.

Acid amides are known to possess hypnotic properties to a certain extent. A number of compounds were prepared, in which one hydrogen atom of the amido-group was replaced by various radicles in the hope of increasing the hypnotic power of the acid amide. Such substances as *cinnamoyl-p-aminoacetophenone* (m. p. 204—205°), *dicinnamoylcarbamide* (m. p. 246°), and *α-bromoisovaleryl-p-aminoacetophenone* (m. p. 113—114°), in which both the acid amide and the substituent, when uncombined, have some

narcotic properties, were found to be quite inactive. By condensing ethyl malonate with malonamide, *malonylmalonamide*,

$$CH_2\langle\begin{matrix}CO\cdot NH\cdot CO\\CO\cdot NH\cdot CO\end{matrix}\rangle CH_2$$

(m. p. 252—253°), was obtained. Two alkyl groups can be attached to one of the "quaternary" carbon atoms and one to the other; the product, however, although somewhat resembling diethylbarbituric acid, a very strong hypnotic, was quite inactive. It was found that when a monoalkylmalonamide was condensed with ethyl malonate or ethyl alkylmalonate, a diketotetrahydropyrimidine was formed of the type $CR\langle\begin{matrix}N—CO\\NH\cdot CO\end{matrix}\rangle CHR$; Ethyl monoalkylmalonates, ethyl dimethyl- and methylethyl-malonates (in part) condensed with malonamide to the eight-membered ring as above, but ethyl methylethylmalonate (in part) and the higher dialkylmalonates give a different condensation product with malonamide, the empirical formulæ of which alone have been determined. None of these compounds was physiologically active, nor was *ethylene*bis-5-*propylbarbituric acid*,

$$CO\langle\begin{matrix}NH\cdot CO\\NH\cdot CO\end{matrix}\rangle C(C_3H_7)\cdot CH_2\cdot CH_2\cdot C(C_3H_7)\langle\begin{matrix}CO\cdot NH\\CO\cdot NH\end{matrix}\rangle CO$$

(which does not melt at 300°). *Dialkylmalonylbenzidines* of the type $CR_2\langle\begin{matrix}CO\cdot NH\cdot C_6H_4\\CO\cdot NH\cdot C_6H_4\end{matrix}\rangle$ were too insoluble to be of any use, whilst iso*butyl allophanate*, $NH_2\cdot CO\cdot NH\cdot CO_2\cdot CH_2\cdot CHMe_2$ (m. p. 178—179°), and *tert.*-amyl allophanate, $NH_2\cdot CO\cdot NH\cdot CO_2\cdot CEtMe_2$ (m. p. 151—152°), were inactive, the hypnotic properties of the respective alcohols being completely neutralised when combined with allophanic acid.

86. "*p*-Benzoyloxybenzaldehyde."

By Frank George Pope.

The benzoyl derivative of *p*-hydroxybenzaldehyde was prepared in 1893 by Kopp (*Annalen*, **277**, 350) by means of the Schotten-Baumann reaction in 10 per cent. potassium hydroxide solution. The melting point of the compound as obtained in this manner is given as 72°. Since an alkali hydroxide solution of such concentration might possibly affect the course of the reaction, it seemed better to carry out the operation in pyridine solution, and consequently 12 grams of the aldehyde were dissolved in 90 c.c. of pyridine and 14 grams of benzoyl chloride added to the solution. The mixture was well shaken for half an hour, and then poured into 300 c.c. of water, the precipitate collected, well washed, and

crystallised from alcohol, when it separated in small, colourless needles, melting sharply at 95°.

As such a considerable difference was found in the melting points, a second preparation was made, using *N*-potassium hydroxide solution. The recrystallised product in this case was also found to melt at 95°, and a mixture of the two specimens melted at 93°. Kopp's specimen thus seems to have been impure, and a few derivatives were therefore prepared in order to characterise the substance. *p*-Benzoyloxybenzaldehyde yielded the following numbers on analysis:

0·1110 gave 0·3026 CO_2 and 0·0480 H_2O. C = 74·35; H = 4·80.
$C_{14}H_{10}O_3$ requires C = 74·34; H = 4·43 per cent.

The *oxime*, prepared in alcoholic solution, crystallised from dilute alcohol in brilliant, colourless needles, melting at 129°:

0·1190 gave 0·3034 CO_2 and 0·050 H_2O. C = 69·51; H = 4·62.
0·1932 „ 10·2 c.c. N_2 (dry) at 22° and 752 mm. N = 5·93.
$C_{14}H_{11}O_3N$ requires C = 69·71; H = 4·57; N = 5·81 per cent.

p-*Benzoyloxybenzonitrile*, $C_6H_5{\cdot}CO{\cdot}O{\cdot}C_6H_4{\cdot}CN$, was obtained by boiling 5 grams of the oxime with 25 grams of acetic anhydride under reflux for two hours. The product was poured, with continual stirring, into 500 c.c. of water, when it set to a solid mass. This was collected, washed, and finally crystallised from dilute alcohol, from which it separates in colourless needles, melting at 95°:

0·1304 gave 0·3610 CO_2 and 0·0476 H_2O. C = 75·70; H = 4·06.
0·2452 „ 13·6 c.c. N_2 (dry) at 18° and 752 mm. N = 6·39.
$C_{14}H_9O_2N$ requires C = 75·34; H = 4·04; N = 6·44 per cent.

p-*Benzoyloxybenzaldehydephenylhydrazone*, prepared in glacial acetic acid solution, crystallises from alcohol, in which it is sparingly soluble, in colourless needles, melting at 178°:

0·1016 gave 0·2830 CO_2 and 0·046 H_2O. C = 75·95; H = 5·03.
0·1038 „ 8 c.c. N_2 (dry) at 18° and 754 mm. N = 8·97.
$C_{20}H_{16}O_2N_2$ requires C = 75·94; H = 5·06; N = 8·86 per cent.

The p-*nitrophenylhydrazone*, obtained in a similar manner, crystallises from hot glacial acetic acid, in which it is sparingly soluble, in small, yellow plates, melting at 208°:

0·1024 gave 0·2490 CO_2 and 0·0378 H_2O. C = 66·32; H = 4·10.
0·1046 „ 10·6 c.c. N_2 (dry) at 18° and 754 mm. N = 11·78.
$C_{20}H_{15}O_4N_3$ requires C = 66·48; H = 4·15; N = 11·63 per cent.

p-*Benzoyloxybenzylidene*-p-*nitroaniline* was prepared by mixing alcoholic solutions of equivalent quantities of *p*-benzoyloxybenzaldehyde and *p*-nitroaniline. After some time a mass of yellow

crystals separated, which were collected and recrystallised from xylene; the substance separated as a felted mass of sulphur-yellow needles, melting at 199°:

0·1322 gave 0·3366 CO_2 and 0·0476 H_2O. C = 69·44; H = 4·00.
0·1468 „ 10·4 c.c. N_2 (dry) at 18° and 754 mm. N = 8·24.
$C_{20}H_{14}N_2O_4$ requires C = 69·36; H = 4·05; N = 8·09 per cent.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Ley, *H.* Die Beziehungen zwischen Farbe und Konstitution bei organischen Verbindungen. Unter Berücksichtigung der Untersuchungsmethoden. pp. viii + 246. ill. Leipzig 1911. (*Recd.* 9/3/11.)
From the Publisher: S. Hirzel.

Redgrove, *Herbert Stanley.* Alchemy: ancient and modern. Being a brief account of the alchemistic doctrines, and their relations, to mysticism on the one hand, and to recent discoveries in physical science on the other hand; together with some particulars regarding the lives and teachings of the most noted alchemists. pp. xiv + 141. ill. London 1911. (*Recd.* 3/3/11.)
From the Publishers: Messrs. William Rider and Son.

Roscoe, *Sir Henry Enfield*, and **Harden**, *Arthur.* Inorganic chemistry for advanced students. 2nd edition. pp. viii + 476. ill. London 1910. (*Recd.* 15/3/11.) From Dr. A. Harden.

Wadmore, *John Mello.* Elementary chemical theory. pp. xi + 275. London 1911. (*Recd.* 8/3/11.)
From the Publishers: Messrs. Methuen and Co.

II. *By Purchase.*

Comanducci, *Ezio.* Die Konstitution der Chinaalkaloide. (Sammlung, Vol. XVI.) Stuttgart 1911.

Bemmelen, *J. M. van.* Gedenkbock aangeboden aan J. M. van Bemmelen, 1830–1910. pp. xxix + 461. Helder 1910. (*Recd.* 15/3/11.)

III. *Pamphlets.*

Abegg, *Richard.* Chemische Affinität, Valenz und das natürliche System der Elemente. (From "Scientia," 1910, 8.)

Gray, *Georgs.* On the dissolved matter contained in rain water collected at Lincoln, New Zealand. pp. 12. Christchurch 1910.

Lewis, *Samuel Judd*. Studien über das elementare Zirkonium. pp. 77. Stuttgart 1910.

Metropolitan Water Board, Sixth Report on research work. By *A. C.* **Houston**. pp. 18. London 1910.

Rossitz Experimental Station. Reports on the Austrian coaldust experiments 1908–1909. Abstracted and translated by the *Colliery Guardian* from the *Oesterreichische Zeitschrift für Berg- und Hüttenwesen*. pp. 36. London 1911.

Queensland, Report of the Agricultural Chemist for the year ending 30th June, 1910. pp. 23. Brisbane 1910.

ERRATA.

1910. P. ix (index number), line 6, *for* "March 7th, 1907" *read* "March 7th, 1867."

—— line 1, from below, *for* "July 15th, 1910" *read* "June 15th, 1910."

1911. P. 40, line 17, from below, *for* "chlorine-containing" *read* "halogen containing."

At the next Ordinary Scientific Meeting on **Thursday**, April **6th**, 1911, at **8.30** p.m., the following papers will be communicated:

"The constituents of rhubarb." By F. Tutin and H. W. B. Clewer.

"6-Nitro-3:4:3′:4′-tetramethyldiphenyl." By A. W. Crossley and C. H. Hampshire.

"Diphenylene, a new aromatic hydrocarbon. Part I." By J. J. Dobbie, J. J. Fox, and A. J. H. Gauge.

"The correlation of viscosity with other physical properties. Part I. The ethenoid and ethinoid unsaturation." By T. P. Hilditch and A. E. Dunstan.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 28/4/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 385

Thursday, March 23rd, 1911, ANNUAL GENERAL MEETING, Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Dr. J. E. MACKENZIE and Dr. R. H. ADERS PLIMMER were appointed Scrutators, and the ballot was opened for the election of Officers and Council for the ensuing year.

The PRESIDENT presented the Report of the Council on the progress of the Society during the past twelve months; and the TREASURER made his statement as to the Society's Income and Expenditure for 1910. After some remarks by Dr. G. McGowan, Mr. A. W. Oke, and Dr. J. A. Voelcker, the Adoption of the Report of the Council, together with the Balance Sheet and Statements of Accounts for the year ended December 31st, 1910, proposed by Mr. DAVID HOWARD and seconded by Dr. F. B. POWER, was carried unanimously.

A Vote of Thanks to the Auditors was proposed by the TREASURER, seconded by Dr. S. SMILES, and acknowledged by Dr. V. H. VELEY.

REPORT OF THE COUNCIL.

Since our last Anniversary Meeting, we, in common with the rest of the Empire, have had to deplore the loss of the gracious

Sovereign whose mission of peace among the nations did so much to foster the steady growth of science. In the address of condolence and of loyalty to his throne which his Majesty King George V. was pleased to receive from the Chemical Society, the Council ventured to call to mind, not only our indebtedness to his late Majesty, but also how much the progress of chemistry in Great Britain was due to the wisdom and foresight of the Prince Consort in the early days of the Society.

The Council is again in a position to report favourably on the progress of the Society, as indicated by an increase in the number of Fellows, and in the list of papers communicated.

On the 31st December, 1909, the number of Fellows was 3,003. During 1910, 165 Fellows have been elected, and 5 were reinstated, the gross total thus being 3,173. The Society has lost 18 Fellows by death; 38 have resigned; the election of 1 Fellow has become void, and 43 Fellows have had their names removed from the list of Fellows for non-payment of annual subscriptions.

The total number of Fellows, therefore, at the 31st December, 1910, was 3,073, showing a net increase of 70 over the preceding year.

The names of the deceased Fellows, with the dates of their election, are:

Richard Abegg (1906).
Robert Barklie (1870).
Robert Haslam Durward Benn, (1904).
Thomas Blackburn (1886).
James Campbell Brown (1867).
Benjamin Samuel Bull (1898).
Michael Carteighe (1864).
John Croysdale (1895).
Frank Barnes Grundy (1903).
Oscar Guttmann (1897).
Edwin Bernard Hadley (1898).
Angus Mackay (1877).
Sir Walter Palmer, Bart. (1879).
Arthur Gaved Phillips (1887).
Richard Wightwick Roberts (1889).
Thomas Bertram Udall (1876).
John Tsawoo White (1889).
Charles Hanson Greville Williams (1862).

The following Fellows have resigned:

John Charles Aylan.
Frederick Nolan Baker.
Frederic Edmund Bowman.
Frank Curzon Britten.
William Burton.
Edward Henry Croghan.
Frank Rawlinson Dudderidge.
Alexander Esilmann.
*William French.
Gilbert Prout Girdwood.
Alfred George Cooper Gwyer.
Frederick John Hambly.
Arthur Lonsdale Hetherington.
Philip Holland.

* Since reinstated.

John Atkinson Jennings.
Harry Lancelot Lee.
Lionel Ludlow.
George Harry Major.
Hubert Fredk. Sankey Marshall.
Leonard Edward Beard Pearse.
Geoffrey Surtees Phillpotts.
William Edmund Francis Powney.
Franklin Ernest Robertson.
Christopher Foulis Roundell.
Edward Cox Seaton.
Leonard Smith.
Alec. Bowring Steven.
Edward Stokes.
Leonard Sumner.
Richard Noel Garrod Thomas.
George Malcolm Thomson.
John Booty Tillott.
William Gaylord Tucker.
James Neill Watts.
James Scott Wilson.
Lewis Thompson Wright.
John William Young.
Thomas Arthur Young.

The names of the Fellows, reinstated by the Council in accordance with Bye-Law IV., are as follows:

Edwin Bayles Atkinson.
Frank Rawlinson Dudderidge.
William French.
Percy Walter Jones.
Charles Frederic Townsend.

The number of Honorary and Foreign Members at the end of 1909 was 33. The Society has to mourn the loss of Professor Stanislao Cannizzaro, Professor Dr. Rudolf Fittig, and Geheim Rath Professor Dr. Hans Landolt, who died during 1910.

It is with great pleasure that the Council offers its congratulations to the following gentlemen, who, during the past year, attained their Jubilee as Fellows of the Society:

Professor Edward Divers, F.R.S.
Mr. Francis Sutton.
Mr. Charles Henry Wood.

During the year 1910, 349 scientific communications have been made to the Society, 273 of which have been published already in the Transactions, and abstracts of all have appeared in the Proceedings.

The volume of Transactions for 1910 contains 2,652 pages, of which 2,601 are occupied by 270 memoirs, the remaining 51 pages being devoted to the Obituary Notices, the Thomsen Memorial Lecture, the Report of the International Committee on Atomic Weights, the Report of the Annual General Meeting, and the Presidential Address; the volume for the preceding year contains 236 memoirs, which occupy 2,133 pages.

The Journal for 1910 contains 4,867 abstracts, which extend to 2,032 pages, whilst the abstracts for 1909 numbered 4,946, and occupied 2,040 pages. The abstracts may be classified as follows:

PART I.

	Pages.	No. of Abstracts.
Organic Chemistry	908	1,634

PART II.

General and Physical Chemistry		961
Inorganic Chemistry		494
Mineralogical Chemistry		118
Physiological Chemistry		700
Chemistry of Vegetable Physiology and Agriculture		287
Analytical Chemistry		673
	1,124	3,233
Total in Parts I. and II.	2,032	4,867

During the past year the Society has rejoiced in having the privilege of offering its congratulations and those of the whole chemical world to five of its Past Presidents, who had completed upwards of fifty years' Fellowship of the Society, namely, Prof. W. Odling, the Right Hon. Sir Henry E. Roscoe, Sir William Crookes, Dr. Hugo Müller, and Dr. A. G. Vernon Harcourt. The Banquet held on Friday, November 11th, 1910, to do honour to these gentlemen will remain a notable event in the history of the Chemical Society. To the great regret of all, Sir Henry Roscoe was, owing to indisposition, unable to be present.

In order to render more complete the records and statistics of the Society, and to make them available to the Fellows at large, the Council has ordered the preparation of a complete chronological list of Fellows from the foundation of the Society in 1841.

Professor Theodore W. Richards has been invited to deliver the Faraday Lecture, and the Council has pleasure in announcing that, through the courtesy of the Managers, an extraordinary meeting of the Society will be held on June 14th in the Lecture Theatre of the Royal Institution, where all the Faraday Lectures have been given. The title of the discourse will be announced in due course.

On behalf of the Society, the Council presented a Congratulatory

Address to its Honorary and Foreign Member, Professor Wilhelm Körner, on the occasion of his seventieth birthday.

By the death of Stanislao Cannizzaro, the Society has lost its Senior Honorary and Foreign Member, elected on June 19th, 1862. Sir William Tilden has accepted the invitation of the Council to deliver a Memorial Lecture in his honour.

The Council has further arranged for the following Memorial Lectures to be delivered:

Antoine Henri Becquerel (d. Aug. 25th, 1908). By Professor Ernest Rutherford, F.R.S.

Marcellin Berthelot (d. March 18th, 1907). By Professor Harold B. Dixon, F.R.S.

Henri Moissan (d. Feb. 20th, 1907). By Sir William Ramsay, K.C.B., F.R.S.

In response to an appeal from the University of Toulouse for help in attempting to render good the almost complete destruction of the Science portion of its library by fire on October 27th last, the Council have decided to present the University with a number of volumes of the Transactions of the Chemical Society. It is unfortunately impossible for the Society on such an occasion as this to present a complete set of its publications, owing to the fact that many of the earlier volumes are out of print.

A number of volumes of the Transactions has also been presented to the University of Manitoba, Winnipeg.

In December, 1909, the International Commission for the publication of Physical-Chemical Constants invited the Society to assist in the work of the Commission by contributing towards the expenses of its work. After due consideration, the Council has decided to make a contribution of £10 out of the funds of the Society for the year 1911, at the expiry of which time the matter will receive further consideration.

An intimation has been received from the Secretary of the International Congress of Applied Chemistry that the Congress will meet in the first half of the month of September, 1912, the opening meeting to be held in Washington, and subsequent meetings of the Congress and its Sections in New York City.

Professor A. Haller, on behalf of the Chemical Society of France, has invited the Chemical Society to co-operate in the formation of an International Committee to consider questions of chemical nomenclature and other matters, with a view to facilitate the reading of chemical researches published in different languages. Professor Haller suggests that established Chemical Societies should appoint delegates to meet once or twice a year, and that questions

INCOME AND EXPENDITURE ACCOUNT

Income.

	£	s.	d.	£	s.	d.
To Life Compositions				219	0	0
,, Admission Fees				636	0	0
,, Annual Subscriptions—						
Received in advance, on account of 1910	267	0	0			
,, during 1910 ,, 1910	4183	0	0			
,, ,, ,, ,, 1909	340	0	0			
,, ,, ,, ,, 1905–8	14	0	0			
	4804	0	0			
Less amount included in last year's Income, being valuation of Arrears as per last Balance Sheet	356	0	0			
	4448	0	0			
Add Arrears at date: 1910 £468; 1909 £14; 1908 £2, estimated to realise as per Balance Sheet	370	0	0			
				4818	0	0
,, Lady Subscribers				3	0	0
,, Investments :—						
Dividends on £6730 Metropolitan Consolidated 3½ per cent. Stock	221	16	4			
,, £1050 London and North Western Railway 3 per cent. Debenture Stock	29	13	2			
,, £1520 14s. 3d. Cardiff Corporation 3 per cent. Stock	42	19	4			
,, £1400 India 2½ per cent. Stock	32	19	4			
,, £2400 Bristol Corporation 2½ per cent. Debenture Stock	56	10	0			
,, £4341 Midland Railway 2½ per cent. Preference Stock	102	3	10			
,, £1200 Leeds Corporation 3 per cent. Stock	33	18	0			
,, £1500 Transvaal 3 per cent. Guaranteed Stock	42	7	6			
,, £1200 North British Railway 3 per cent. Debenture Stock	33	18	0			
,, £700 Canada 3½ per cent. Stock 1930/50	11	10	8			
,, Income Tax Recovered	30	2	0			
,, Interest on Deposit Account	12	6	5			
				650	4	7
Publications :—						
Sales :						
Journals	877	15	6			
Proceedings	29	1	8			
General Index	19	17	4			
Library Catalogue	1	1	9			
Atomic Weight Tables	1	0	8			
Annual Reports on the Progress of Chemistry	140	7	0			
	1069	3	11			
Less Publishers' Commission	102	18	9			
	966	5	2			
Proceeds of Advertisements in Journal... £125 4 1						
Less Commission 4 10 3						
	120	13	10			
				1086	19	0
,, Sale of Waste Paper				1	0	9
,, Subscriptions from other Societies :—						
Society of Chemical Industry	9	9	0			
Society of Public Analysts	11	0	6			
Faraday Society	2	2	0			
Optical Society	8	18	6			
Optical Convention	1	11	6			
				33	1	6
,, Balance, being excess of Expenditure over Income, carried to Balance Sheet				147	6	4
				£7594	12	2

I have examined the above Accounts with the Books and Vouchers of the Society, and and the Investments

23, Queen Victoria Street,
London, E.C.
13*th March*, 1911.

W. B. KEEN,
Chartered Accountant.

FOR THE YEAR ENDED 31ST DECEMBER, 1910.

Expenditure.

	£ s. d.	£ s. d.
By Expenses on account of Journal and Proceedings:—		
Salary of Editor, including Indexing	570 0 0	
Salary of Sub-Editor	200 0 0	
Editorial Postages	24 2 5	
Abstractors' Fees	485 5 10	
Printing of Journal	2879 7 11	
Banding	62 3 2	
Printing of Advertisements	45 1 5	
Wrappers and Addressing	115 10 9	
Distribution of Journal	597 2 8	
Authors' Copies	191 13 6	
Insurance of Stock at Clay's	7 0 0	
		5177 7 8
Printing of Proceedings	223 12 8	
Banding ,,	7 8 1	
Distribution ,,	35 3 1	
		266 3 10
,, Annual Reports on the Progress of Chemistry		429 10 1
,, Purchase of back numbers of Journal		5 10 3
,, List of Fellows		64 7 3
,, Library Expenses:—		
Salary of Librarian and Assistant	170 8 0	
Books and Periodicals	244 4 3	
Binding	67 1 7	
		481 13 10
,, Indexing for International Catalogue		30 0 0
,, Balance of Dinner Account		91 15 2
,, Administrative Expenses:—		
Salary of Assistant Secretary	270 0 0	
Salary of Office Assistant	46 16 8	
Wages (Commissionaire, Housekeeper, and Charwoman)	164 19 6	
Pension, Mrs. Hall	22 10 0	
Coal and Lighting	39 10 7	
House Expenses and Repairs	144 0 4	
Tea Expenses	27 15 1	
Insurances	9 13 10	
Accountants' Charges, 1910	21 0 0	
Commission on Recovery of Income Tax	1 10 1	
Printing	96 11 8	
Stationery	64 8 9	
Illuminated Addresses	5 18 0	
Postages	105 8 1	
Valuation of Furniture	4 4 0	
Miscellaneous Expenses	23 17 6	
		1048 4 1
		£7594 12 2

certify them to be in accordance therewith. I have also verified the Balance at the Bankers

Approved— VICTOR H. VELEY,
FREDERICK B. POWER.
JOHN M. THOMSON.

BALANCE SHEET.—THE CHEMICAL SOCIETY, 31st December, 1910.

Liabilities.

	£ s. d.	£ s. d.
To Subscriptions received in advance		308 10 0
,, Cash received on Account of Annual Report, Vol. VII. (not published)		30 18 6
,, Sundry Creditors		1589 7 5
,, Research Fund :—		
As per last Balance Sheet	10475 15 4	
Add Excess of Income over Expenditure for the year	29 6 5	
		10505 1 9
		12433 17 8
,, Chemical Society : Excess of Assets over Liabilities :—		
As per last Balance Sheet...	20304 16 5	
Less Excess of Expenditure over Income for the year	147 6 4	
		20157 10 1
	£32591 7 9	

Assets.

	£ s. d.	£ s. d.
By Investments (value when acquired):—		
£6730 Metropolitan Consolidated 3½ per cent. Stock	7212 8 6	
£1050 London and North Western Railway 3 per cent. Debenture Stock	839 12 0	
£1520 14*s.* 3*d.* Cardiff Corporation 3 per cent. Stock	1650 0 0	
£1400 India 2½ per cent. Stock	1316 1 0	
£2400 Bristol Corporation 2½ per cent. Debenture Stock	2070 2 0	
£4341 Midland Railway 2½ per cent. Preference Stock	3572 2 5	
£1200 Leeds Corporation 3 per cent. Stock	1143 1 0	
£1500 Transvaal 3 per cent. Guaranteed Stock... ...	1460 13 6	
£1200 North British Railway 3 per cent. Debenture-Stock	1033 11 0	
£700 Canada 3½ per cent Stock, 1930/50	704 8 6	
		21001 19 11
(Estimated present value of Investments, £18553 16*s.* 3*d.*)		
,, Sundry Debtors :—		
Optical Society	8 18 6	
Advertising Accounts	62 15 5	
Messrs. Gurney & Jackson	426 15 5	
Telephone Deposit	1 0 0	
		499 9 2
,, Subscriptions in Arrear, £484. Estimated to realise ..		370 0 0
,, Insurance paid in advance		66 17 1
,, Cash at Bank on Current Account	136 16 11	
,, Cash in hand	11 2 11	
		147 19 10
,, Research Fund :—		
Investments (value when acquired):		
£1000 North British Railway 4 per cent. No. 1 Preference Stock	1010 0 0	
£4400 Metropolitan Consolidated 3½ per cent. Stock	4587 18 0	
£1034 Great Western Railway 2½ per cent. Debenture Stock	1049 15 11	
£1142 16*s.* New South Wales 3 per cent. Stock ...	1000 0 0	
£1122 Metropolitan Water Board 3 per cent. "B" Stock	1002 16 9	
£1365 Midland Railway 2½ per cent. Debenture Stock	1010 0 9	
£806 Victoria 3 per cent. Stock	706 6 2	
	10366 17 7	
(Estimated present value of Research Fund Investments, £9769 6*s.* 11*d.*)		
,, Cash at Bank	138 4 2	
		10505 1 9
	£32591 7 9	

Note.—The estimated value of the Library, exclusive of the Stock of the Society's own publications, is £7200, and of the Furniture, &c., £3850.

£82501 7 9

£82501 7 9

Research Fund Income and Expenditure Account for the Year ended 31st December, 1910.

Income.

	£ s. d.	£ s. d.
To Dividends on:—		
£1000 North British Railway 4 per cent. No. 1 Preference Stock	37 13 4	
£4400 Metropolitan Consolidated 2½ per cent. Stock	145 0 4	
£1034 Great Western Railway 2½ per cent. Debenture Stock	24 6 10	
£1142 16*s.* New South Wales 3 per cent. Stock	32 5 10	
£1122 Metropolitan Water Board 3 per cent. "B" Stock	31 14 0	
£1365 Midland Railway 2½ per cent. Debenture Stock	32 2 8	
£806 Victoria 3 per cent. Stock	22 15 4	
		325 18 4
,, Repayment of Research Grants:—		
R. D. Abell	1 16 2	
J. W. Mellor	2 4 9	
E. A. Werner	6 9 4	
J. C. Cain	4 9 6	
F. G. Pope	5 6	
T. S. Price	7 1	
Miss I. Smedley	4	
A. J. Allmand	16 2	
H. W. Bywaters	5 10 4	
W. B. Tuck	2 12 11	
Miss A. Homer	7 0	
N. L. Gebhard	3 6 9	
J. A. Carpenter	17 16 3	
		46 2 1
,, Sale of old platinum		7 10 1
,, Return of Cost of broken apparatus		3 4 0
,, Income Tax Recovered		18 10 6
		£401 5 0

Expenditure.

By Grants to—	£ s. d.		£ s. d.
H. J. Adlam	6 0 0	*Brought forward*—180	0 0
W. C. Ball	5 0 0	H. Browning, jun.	5 0 0
C. O. Bannister	10 0 0	A. Clayton	5 0 0
H. T. Clarke	5 0 0	W. W. Close	5 0 0
A. Clayton	5 0 0	J. B. Cohen	5 0 0
Miss M. E. Dobson	7 0 0	C. H. Desch	5 0 0
A. E. Dunstan	5 0 0	J. G. M. Dunlop	15 0 0
A. J. Ewins	5 0 0	F. P. Dunn	7 0 0
J. A. N. Friend	8 0 0	A. E. Dunstan	7 0 0
C. S. Gibson	15 0 0	J. Ferns	6 0 0
C. Gilling	5 0 0	W. Godden	5 0 0
E. Hope	7 0 0	V. J. Harding	5 0 0
T. M. Lowry	7 0 0	W. N. Haworth	20 0 0
W. H. Mills	15 0 0	A. Holt, jun.	8 0 0
J. R. Partington	10 0 0	F. Holt	10 0 0
W. H. Patterson	5 0 0	E. Hope	15 0 0
J. N. Pring	10 0 0	W. J. Jarrard	5 0 0
R. Robinson	10 0 0	F. R. Lankshear	10 0 0
N. V. Sidgwick	10 0 0	A. Lapworth	10 0 0
J. L. Simonsen	10 0 0	H. R. Le Sueur	7 0 0
J. J. Sudborough	5 0 0	S. P. U. Pickering	5 0 0
F. B. Thole	5 0 0	W. M. Roberts	5 0 0
N. Bland	5 0 0	S. Smiles	10 0 0
O. L. Brady	5 0 0	Miss G. M. Walsh	6 0 0
		A. W. Stewart	10 0 0
Carried forward—180	0 0		371 0 0
,, Commission on Recovery of Income Tax			18 7
,, Balance, being Excess of Income over Expenditure carried to Balance Sheet			29 6 5
			£401 5 0

I have examined the above Account with the Books and Vouchers of the Society, and certify it to be in accordance therewith. I have also verified the Balance at the Bankers and the Investments.

W. B. Keen,
Chartered Accountant.

13th March, 1911.

Approved—
Victor H. Veley.
Frederick B. Power.
John M. Thomson.

considered at such meetings should be referred to and discussed by the several Societies independently, and then finally by the International Committee.

The Council has expressed its willingness to appoint delegates to serve on the International Committee, should such be formed.

The Chemical Society has during the past year received, through the kindness of Professor G. Carey Foster, a copy of Richard Watson's "Pars Mettallurgica Institutium Chemicarum"; the Right Hon. Sir Henry E. Roscoe has presented a unique set of photograph portraits of Chevreul; and Mr. Ernest de la Rue has added to the collection of portraits one of the late Warren de la Rue, who was President of the Society during two periods, 1867–1869 and 1879–1880. Valuable presents of the Society's publications have also been received from Mr. J. McDougall and Dr. E. Cox Seaton.

During the year, 1,918 books were borrowed from the Library, as against 1,548 during 1909; of these, 553 were issued by post, as compared with 347 in the preceding year.

The additions to the Library comprise: 163 books, of which 80 were presented, 431 volumes of periodicals (representing 236 journals), and 141 pamphlets, as against 142 books, 418 volumes of periodicals (representing 243 journals), and 80 pamphlets last year.

Although the income of the Society for the year 1910 falls short of its expenditure by no less than £147 6*s*. 4*d*., this need hardly cause any serious alarm, nor must it be assumed that henceforth this must be our usual condition. This undesirable result on the year's working has been brought about by several causes acting simultaneously.

The increase in income for 1909 over that for 1908 was £252, whilst that for 1910, from all sources, only exceeded that for 1909 by £59 17*s*. 10*d*., the respective amounts being £7,447 5*s*. 10*d*. for 1910, and £7,387 8*s*. for 1909. Whilst our income has improved so little, the expenditure has risen from £7,028 3*s*. 5*d*. to £7,594 12*s*. 2*d*., an increase of £566 8*s*. 9*d*. As mentioned earlier in the report, the volume of our *Transactions* has increased by more than 500 pages, that is, roughly, a quarter more than last year. This is reflected in the increase of £399 7*s*. 5*d*. in the cost of the Journal alone. Administrative expenses have also increased much more than usual, owing to certain expenses which had to be met this year of an abnormal character, and which are not likely to recur for several years. The total increase under this head is £188 4*s*. One other item which calls for remark is the large deficit on the Dinner Account, which has to be met from the funds of the Society. This time it amounts to £91 15*s*. 2*d*., but

it ought to be pointed out that this is unusually high, and is due, in part, to the postponement of the Banquet from May 26th until November 11th, necessitated by the death of King Edward on May 8th. In view of the narrow margin between our income and expenditure it is to be hoped that some satisfactory method of avoiding this drain upon our resources may be devised and adopted in arranging for the next Anniversary Dinner, which, in the ordinary course, should fall in March, 1913.

Since the Officers of the Society have undertaken the management of the advertisements a profit of £75 12*s.* 5*d.* has resulted, whereas last year our net gain from this source was a little under £10.

The snapping of one of the links with the past, which all must regret, has been brought about by the death, in September, of Mrs. Emily Hall. The pension of £30 a year, granted in 1903 to Mrs. Hall on the death of her husband, Mr. Josiah Hall, for twenty-five years the courteous collector for the Society, thus lapses.

The income of the Research Fund exceeds the expenditure by £29 6*s.* 5*d.* This is due chiefly to the balances of grants made in previous years which remained unexpended having been returned by the grantees. These amount to £46 2*s.* 1*d.*, and this sum is now available for redistribution. The normal income of the Fund is £344, and a sum of £371 was divided amongst forty-eight applicants in amounts ranging from £5 to £20.

A Vote of Thanks to the Treasurer, Hon. Secretaries, Foreign Secretary, and Council for their services during the past year was proposed by Mr. A. D. HALL, seconded by Mr. J. SPILLER, and acknowledged by Dr. J. J. DOBBIE.

The PRESIDENT then delivered his address, entitled, "On the initiation and propogation of explosions." Sir WILLIAM TILDEN proposed a vote of thanks to the President, coupled with the request that he would allow his Address to be printed in the Transactions; the motion was seconded by Sir WILLIAM RAMSAY, and carried with acclamation, the PRESIDENT making acknowledgment.

The Scrutators then presented their Report, and the PRESIDENT declared that the following had been elected as Officers and Council for the ensuing year:

President: Percy F. Frankland, Ph.D., LL.D., F.R.S.

Vice-Presidents who have filled the Office of President: H. E. Armstrong, Ph.D., LL.D., F.R.S.; A. Crum Brown, D.Sc., LL.D.,

F.R.S.; Sir William Crookes, O.M., D.Sc., F.R.S.; Sir James Dewar, M.A., LL.D., F.R.S.; H. B. Dixon, M.A., Ph.D., F.R.S.; A. G. Vernon Harcourt, M.A., D.C.L., F.R.S.; R. Meldola, F.R.S.; H. Müller, Ph.D., LL.D., F.R.S.; W. Odling, M.A., M.B., F.R.S.; Sir William Ramsay, K.C.B., LL.D., F.R.S.; J. Emerson Reynolds, Sc.D., M.D., F.R.S.; the Rt. Hon. Sir Henry E. Roscoe, LL.D., F.R.S.; Sir Edward Thorpe, C.B., LL.D., F.R.S.; Sir William A. Tilden, D.Sc., F.R.S.

Vice-Presidents: G. T. Beilby, LL.D., F.R.S.; J. Norman Collie, Ph.D., F.R.S.; M. O. Forster, D.Sc., Ph.D., F.R.S.; A. Liversidge, LL.D., F.R.S.; W. J. Pope, M.A., F.R.S.; J. Walker, D.Sc., Ph.D., F.R.S.

Treasurer: Alexander Scott, M.A., D.Sc., F.R.S.

Secretaries: Arthur W. Crossley, D.Sc., Ph.D., F.R.S.; G. T. Morgan, D.Sc.

Foreign Secretary: Horace T. Brown, LL.D., F.R.S.

Ordinary Members of Council: W. A. Bone, D.Sc., Ph.D., F.R.S.; W. R. Bousfield, M.A., K.C.; Adrian J. Brown, M.Sc.; J. B. Cohen, Ph.D., B.Sc.; C. F. Cross, B.Sc.; C. E. Groves, F.R.S.; A. R. Ling; A. McKenzie, M.A., D.Sc., Ph.D.; Hugh Marshall, D.Sc., F.R.S.; J. C. Philip, M.A., D.Sc., Ph.D.; Sir Boverton Redwood, D.Sc.; A. E. H. Tutton, M.A., D.Sc., F.R.S.

Thursday, April 6th, 1911, Professor Percy F. Frankland, LL.D., F.R.S., President, in the Chair.

The President made the following announcements:

(*a*) That the Council had appointed the following Committees for 1911–1912:

Finance Committee: Messrs. E. G. Hooper, G. T. Moody, Sir Edward Thorpe, Sir William Tilden, and the Officers.

House Committee: Messrs. W. R. Dunstan, R. Messel, J. E. Reynolds, J. M. Thomson, Sir Edward Thorpe, Sir William Tilden, and the Officers.

Library Committee: Messrs. B. Dyer, W. Gowland, A. Harden, J. T. Hewitt, C. A. Keane, A. R. Ling, R. Meldola, E. J. Mills,

J. C. Philip, J. M. Thomson (Chairman), Sir William A. Tilden, J. A. Voelcker, the Editor, and the Officers.

Publication Committee: Messrs. J. N. Collie, B. Dyer, M. O. Forster, C. E. Groves, J. T. Hewitt, A. McKenzie, J. C. Philip, Sir William Ramsay, and the Officers.

Research Fund Committee: Messrs. H. B. Baker, G. T. Beilby, W. R. Bousfield, J. N. Collie, H. B. Dixon, A. Liversidge, R. Meldola, Sir Alexander Pedler, W. J. Pope, J. E. Reynolds, and the Officers.

(*b*) That the Faraday Lecture would be delivered on Wednesday, June 14th, 1911, at 8 p.m., by Professor Theodor W. Richards, in the Lecture Room of the Royal Institution.

(*b*) That Sir William A. Tilden had been appointed by the Council to act as delegate of the Society on the occasion of the Celebration of the 500th Anniversary of the Foundation of St. Andrew's University.

Certificates were read for the first time in favour of Messrs.:

Ernest Andrew Atkins, 71, East Hill, Wandsworth, S.W.
George Arthur Bradshaw, M.Sc., 28, Raymond Street, Bury.
Arthur Frederick Clarke, 12, York Avenue, Gillingham.
Charles Ernest Cooke, 35, Sebert Road, Forest Gate.
Edgar Harold Gardner, 34, Salisbury Avenue, Colchester.
Rowland Lewis Goold, 5, Corporation Street, Birmingham.
Edward Lionel Joseph, 96, Victoria Street, S.W.
Richard William Merriman, M.A., 244, Victoria Park Road, S. Hackney

Of the following papers, those marked * were read:

*87. "The constituents of rhubarb."
By Frank Tutin and Hubert William Bentley Clewer.

The material employed for this investigation consisted of the best quality of sun-dried "Shensi" rhubarb. An alcoholic extract of the drug, when distilled with steam, yielded small amounts of palmitic and chrysophanic acids, together with a hexoic acid and some essential oil.

The portion of the extract which was soluble in water yielded cinnamic and gallic acids, rhein, emodin, aloe-emodin, emodin monomethyl ether, chrysophanic acid, and a new anthraquinone derivative, $C_{17}H_{10}O_6$ (m. p. 295—297°), which it is proposed to designate *rheinolic acid*. It yielded, furthermore, a crystalline mixture of the glucosides of rhein, emodin, aloe-emodin, emodin monomethyl

ether, and chrysophanic acid; dextrose; lævulose; tannin; and an amorphous, non-glucosidic resin. This resin, on hydrolysis, gave small amounts of gallic and cinnamic acids, rhein, emodin, aloe-emodin, emodin monomethyl ether, and chrysophanic acid, together with a new *compound*, $C_{14}H_{12}O_3$ (m. p. 256°), which is probably a *trihydroxydihydroanthracene*.

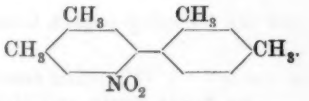
The portion of the extract undissolved by water yielded a trace of a hydrocarbon (m. p. 64°); a phytosterol (verosterol), $C_{27}H_{46}O$; a mixture of fatty acids, consisting of palmitic, stearic, oleic, linolic, and linolenic acids, both free and combined; rhein; rheinolic acid; emodin; aloe-emodin; emodin monomethyl ether; chrysophanic acid; and a trace of a substance which did not fuse at 340°, but yielded an acetyl derivative, melting at 335°. It also gave some amorphous products, and a further quantity of the crystalline mixture of the glucosides of the anthraquinone derivatives.

Of the anthraquinone derivatives, only aloe-emodin and chrysophanic acid had any purgative action, the mixture of glucosides being quite inert. The chief purgative principle is the above-mentioned non-glucosidic resin.

*88. "6-Nitro-3:4:3′:4′-tetramethyldiphenyl."

By Arthur William Crossley and Charles Herbert Hampshire.

In continuation of experiments already described (*Proc.*, 1909, **25**, 162), the nitro-group has been eliminated from the nitrotetramethyldiphenyl prepared by the action of nitric acid on *o*-xylene, and the resulting tetramethyldiphenyl has been proved identical with 3:4:3′:4′-tetramethyldiphenyl:



The latter hydrocarbon has been synthesised from 4-iodo-*o*-xylene under the influence of copper powder.

No direct evidence is forthcoming as to the position of the nitro-group, but indirect evidence supports the conclusion that it occupies position 6.

*89. "Diphenylene, a new aromatic hydrocarbon. Part I." By James Johnston Dobbie, John Jacob Fox, and Arthur Josiah Hoffmeister Gauge.

Diphenylene, $C_6H_4{:}C_6H_4$, was prepared by the prolonged action of sodium on 2:2′-dibromodiphenyl (melting at 81°) dissolved in dry

ether. The yield of the crude material is practically quantitative. This hydrocarbon dissolves readily in the usual organic solvents, and is best crystallised from light petroleum or alcohol; from such solutions it separates in flat prisms, melting at 74·5—75°. It closely resembles diphenyl in appearance and odour, but differs in melting point. When mixed with diphenyl, its melting point is depressed several degrees. Its absorption spectrum shows considerably greater general absorption than that of diphenyl.

The analysis and molecular-weight determinations gave results agreeing with the formula $C_{12}H_8$.

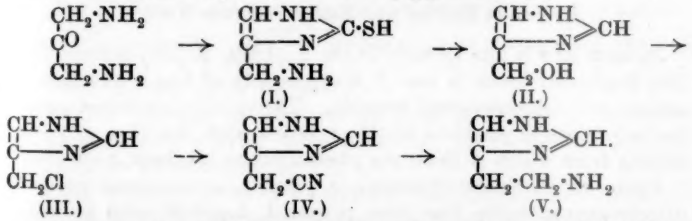
Discussion.

The President pointed out that benzene was usually stated to yield some phthalic acid on oxidation; it was therefore very remarkable that the authors should have found that diphenyl did not. Possibly the benzene used in the experiments on which the statement was based was not really pure.

*90. "A new synthesis of 4(or 5)-β-aminoethylglyoxaline, one of the active principles of ergot." By Frank Lee Pyman.

The following synthesis of 4(or 5-)-β-aminoethylglyoxaline affords a convenient method for its preparation.

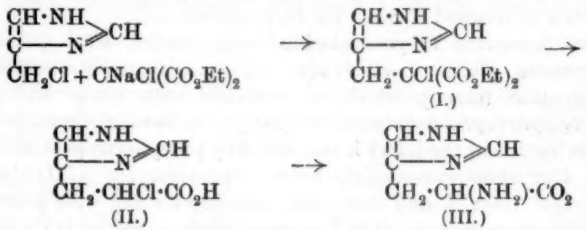
Diaminoacetone dihydrochloride when heated with potassium thiocyanate yields 2-*thiol*-4(or 5-)-*aminomethylglyoxaline* (I) [m. p. 188° (corr.)], which on oxidation with nitric acid gives 4(or 5)-*hydroxymethylglyoxaline* (II) [m. p. 93—94° (corr.)]. The hydrochloride of the latter is converted by phosphorus pentachloride into 4(or 5)-*chloromethylglyoxaline hydrochloride* (III) [m. p. 144—145° (corr.)], and this, when suitably treated with potassium cyanide, gives rise to 4(or 5)-*cyanomethylglyoxaline* (IV) [m. p. 138—140° (corr.)]. The latter base, on reduction with sodium and alcohol, yields 4(or 5)-β-aminoethylglyoxaline (V).



A number of salts of these compounds, and several derivatives obtained as by-products in the various stages of the synthesis, were also described.

***91. "The synthesis of *r*-histidine." (Preliminary note.)**
By Frank Lee Pyman.

4(or 5)-Chloromethylglyoxaline hydrochloride, of which the synthetical preparation is described in the preceding communication, is a valuable compound for the synthesis of substances containing the glyoxaline complex, for it reacts readily with ethyl sodioacetoacetate, ethyl sodiomalonate, and similarly constituted compounds, forming the corresponding 4(or 5)-glyoxalinemethyl ($C_3H_3N_2 \cdot CH_2^-$) derivatives. By the use of this salt, the synthesis of *r*-histidine has been effected as follows. 4(or 5)-Chloromethylglyoxaline hydrochloride and ethyl sodiochloromalonate readily condense, yielding *ethyl* 4(or 5)-*glyoxalinemethylchloromalonate* (I), of which the *sesquioxalate*, $(C_{11}H_{15}O_4N_2Cl)_4(C_2H_2O_4)_3$, melts and decomposes at 176° (corr.). This base, on hydrolysis with 20 per cent. hydrochloric acid, gives r-*α*-*chloro*-*β*-*glyoxaline*-4(or 5)-*propionic acid* (II) [m. p. 201° (corr.)], which, when heated with strong ammonia at 110°, yields *r*-histidine (*r*-*α*-amino-*β*-glyoxaline-4(or 5)-propionic acid, (III) [melting and decomposing at 283° (corr.)], identical in all respects with that obtained by racemising the naturally-occurring amino-acid *l*-histidine.



***92. "A synthesis of phenanthrene."**
By James Kenner and Emily Gertrude Turner.

Jackson and White (*Amer. Chem. J.*, 1880, **2**, 383) showed that dihydrophenanthrene is one of the products of the interaction of sodium with *o*-bromobenzyl bromide. The authors are investigating the intermediate products of this reaction with the view of determining from which of them the phenanthrene synthesis is effected.

From ωω′-dibromo-2:2′-ditolyl, a possible intermediate product, dihydrophenanthrene has been prepared, together with a hydrocarbon, melting at 212—213°, the nature of which has not yet been determined. From ωωω′ω′-tetrabromo-2:2′-ditolyl a 67 per cent. yield of phenanthrene has been obtained.

ωω'-Dibromo-2:2'-ditolyl, $CH_2Br{\cdot}C_6H_4{\cdot}C_6H_4{\cdot}CH_2Br$, rhombic prisms, m. p. 88°, and *ωωω'ω'-tetrabromo-2:2'-ditolyl*,

$$CHBr_2{\cdot}C_6H_4{\cdot}C_6H_4{\cdot}CHBr_2,$$

rhombic prisms, m. p. 138°, are formed by bromination of 2:2'-ditolyl at 110°.

2:2'-*Diphenylenediformaldehyde*, $CHO{\cdot}C_6H_4{\cdot}C_6H_4{\cdot}CHO$, thin plates, m. p. 62—63° (*hydrazone*, rectangular plates, m. p. 102° with decomposition), was prepared by the hydrolysis of tetrabromoditolyl in dilute alcoholic solution with potassium oxalate. Preliminary experiments have shown that it undergoes condensation when boiled with potassium cyanide, but the product does not yield phenanthraquinone on oxidation.

From the dibromide, 2:2'-*diphenylenediacetonitrile*,

$$CN{\cdot}CH_2{\cdot}C_6H_4{\cdot}C_6H_4{\cdot}CH_2{\cdot}CN,$$

rectangular plates, m. p. 77°, the *diamide*,

$$NH_2{\cdot}CO{\cdot}CH_2{\cdot}C_6H_4{\cdot}C_6H_4{\cdot}CH_2{\cdot}CO{\cdot}NH_2,$$

m. p. 206°, and the *dicarboxylic acid*,

$$CO_2H{\cdot}CH_2{\cdot}C_6H_4{\cdot}C_6H_4{\cdot}CH_2{\cdot}CO_2H,$$

needles, m. p. 168°, have also been prepared in connexion with these studies on cyclic condensation.

93. "The correlation of viscosity with other physical properties. Part I. The ethenoid and ethinoid unsaturation." By Thomas Percy Hilditch and Albert Ernest Dunstan.

The authors intend in this series of papers to compare the viscosity coefficients of a variety of compounds with their molecular refractivity and dispersive power, molecular volume, magnetic rotatory power, optical activity, and other constitutive properties, with the aim of collating a mass of experimental evidence bearing on the general problem of chemical constitution and physical properties.

They propose to obtain comparable viscosity data in two ways:

(*a*) The quantity $\frac{\eta \times 10^6}{\text{Mol. vol}}$ has been shown to be approximately constant for any given series.

(*b*) The viscosity of solutions of fixed molecular concentration gives a sufficiently exact value for comparative purposes when an appropriate solvent is used.

Seven different series of compounds containing the ethenoid and ethinoid linkings have been studied, and it has been found that, in general, the ethinoid linking produces a greater exaltation in a number of physical properties than the ethenoid. When, however, the unsaturated grouping is conjugated with another nucleus

possessing considerable residual affinity ($C_6H_5^-$,CO_2H^-,), then the ethenoid anomaly approaches that of the ethinoid.

94. "Chemical action induced by cathode rays and canal rays." By Edgar Philip Perman.

The transmutation of copper, thorium, and uranium by means of cathode rays and canal rays has been attempted, and the chemical effect of canal rays on a number of substances has been studied. The following are the chief conclusions:

(*a*) Neither cathode rays nor canal rays produce any transmutation of the elements.

(*b*) Canal rays in air or oxygen have a strong oxidising action.

(*c*) The oxidising action appears to be mostly direct, but is accompanied by a scattering effect.

(*d*) Many substances are decomposed by the action of canal rays independently of the nature of the gas in which the rays are produced.

95. "Compounds of copper benzoate with pyridine and quinoline." By Oscar Lisle Brady.

While attempting to acetylate a compound contaminated with copper powder, by means of benzoyl chloride and glacial acetic acid in pyridine solution, a quantity of blue, crystalline material was obtained. This was found to contain copper, and on decomposition with alkali hydroxide or acids, pyridine and benzoic acid were formed.

Further experiment showed that the substance may be prepared directly from copper benzoate and pyridine.

Copper benzoate was dissolved in boiling pyridine, and the deep blue liquid allowed to cool. The blue, crystalline material which separated was collected and washed with ether.

Found: C = 58·5; H = 5·9.

$Cu(C_7H_5O_2)_2,2C_5H_5N,2H_2O$ requires C = 57·6; H = 4·8 per cent.

On heating in the steam-oven, the compound lost 20·3 per cent. of its weight, yielding a bright green substance, which contained C = 57·4; H = 4·8; CuO = 19·0.

$Cu(C_7H_5O_2)_2,2C_5H_5N,2H_2O$ loses 19·5 per cent. of its weight to give $Cu(C_7H_5O_2),C_5H_5N,H_2O$, which requires C = 56·6; H = 4·2; CuO = 19·6 per cent.

The loss in weight on heating, and the percentage of carbon and hydrogen being high, whilst the value for copper oxide is low, may be accounted for by the presence of free pyridine, as both compounds have a strong odour of the base.

Similar results were obtained when quinoline was substituted for pyridine, but the blue compound was less stable, washing with ether being enough to remove quinoline with the formation of a green substance.

The blue quinoline compound was found to contain C = 70·5; H = 5·8; and the green compound obtained from it by heating in the steam-oven gave C = 61·7; H = 4·2; CuO = 18·0:

$Cu(C_7H_5O_2)_2,4C_9H_7N,2H_2O$ requires C = 69·9; H = 4·9 per cent.
$Cu(C_7H_5O_2)_2,C_9H_7N,H_2O$ requires C = 61·4; H = 4·2;
CuO = 17·5 per cent.

96. "Experiments on the synthesis of the terpenes. Part XVIII. Synthesis of Δ^5-*o*-menthenol(8), Δ^6-*o*-menthenol(8), and the corresponding menthadienes." By William Henry Perkin, jun.

The *cis*- and *trans*-1-methyl*cyclo*hexan-6-ol-2-carboxylic acids, which are produced by the reduction of 6-hydroxy-*o*-toluic acid, are converted into the corresponding 6-bromo-derivatives, and the esters of these, when digested with diethylaniline, give rise to a mixture of *ethyl* 1-*methyl*-Δ^5- and 1-*methyl*-Δ^6-cyclo*hexenecarboxylates*.

These are separated by fractional esterification and hydrolysis, and are converted, by means of magnesium methyl iodide, into the corresponding menthenols, from which the corresponding menthadienes are obtained by shaking with cold, 5 per cent. sulphuric acid or by boiling with 6 per cent. oxalic acid.

97. "Experiments on the synthesis of the terpenes. Part XIX. Synthesis of *cis*- and *trans*-Δ^3-*o*-menthenol(8), Δ^4-*o*-menthenol(8), and the corresponding menthadienes." By William Henry Perkin, jun.

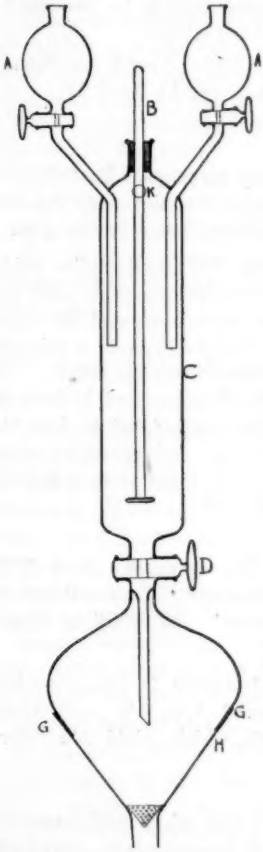
By the same series of reactions as described in the preceding paper, 4-hydroxy-*o*-toluic acid is converted into cis- and trans-Δ^3-*o-menthenol*(8) and Δ^4-*o-menthenol*(8), which yield the corresponding *menthadienes*.

98. "The condensation of ethyl crotonate and ethyl methylacrylate with ethyl cyanoacetate and ethyl bromoacetate. Synthesis of γ-methylbutane-$\alpha\beta\delta$-tricarboxylic acid and pentane-$\alpha\beta\delta$-tricarboxylic acid." By Edward Hope and William Henry Perkin, jun.

When ethyl crotonate is condensed with ethyl sodiocyanoacetate and the product treated with ethyl bromoacetate, ethyl β-cyano-γ-methylbutane-$\alpha\beta\delta$-tricarboxylate is obtained. On hydrolysis and

elimination of carbon dioxide, this yields γ-methylbutane-αβδ-tricarboxylic acid.

By a similar series of reactions pentane-αβδ-tricarboxylic acid is prepared from ethyl methylacrylate and ethyl sodiocyanoacetate. These acids form the starting point for the preparation of *cyclo*pentanonecarboxylic acids.



99. **"The volume of a solute in solution. Part II. The influences of molecular association, solvate formation, and ionisation." By Dan Tyrer.**

The specific solution volumes of various substances which polymerise in solution have been measured in normal non-associated solvents. It was found that molecular association is quite without influence on the specific solution volume of the solute. Measurements were made also for solutions in which solvates are formed. In these cases it was found that, as a general rule, the specific volume of the solute in solution increased regularly with increase of the concentration. Several exceptions, however, to this rule were observed. In the case of aqueous solution, the conclusion was drawn that hydrates exist in the majority of cases, and with strong electrolytes the evidence points to the existence of hydrated ions.

100. **"An apparatus for precipitating, filtering, and drying in an inert gas." By James Brierley Firth and James Eckersley Myers.**

The apparatus designed for the above purpose is shown in the accompanying sketch.

The reacting liquids are placed in the funnels *A*, *A*, and the remainder of the apparatus is evacuated through a Büchner flask fitted to the filter-funnel *H*. The apparatus is then filled with the inert gas through a side-tube at *K*. The tap *D* being closed, the reacting liquids are run into the precipitating tube *C*, and are

mixed by means of the stirrer *B*, which slides in a rubber stopper lubricated with rubber grease. When the reaction is complete, the tap *D*, which has a wide bore, is opened, and the precipitate filtered off in the funnel *H*. The washing and drying are carried out by drawing suitable liquids through the precipitate, and finally aspirating a stream of the inert gas to remove the liquids used for drying. There is a ground glass joint at *G*, by means of which the funnel is prepared for filtration and the precipitate is removed. This apparatus is being used with satisfactory results in the preparation of copper hydride.

101. "Triketohydrindene hydrate. Part III. Its relation to alloxan." By Siegfried Ruhemann.

β-Hydrindone, as well as 1:3-diketohydrindene, may be transformed into triketohydrindene hydrate by Sachs-Barschall's method, but they are less suitable for the preparation of this compound than α-hydrindone (see Ruhemann, *Trans.*, 1910, **97**, 1438). The blue colour reaction which the triketone yields with amino-acids (*Trans.*, 1910, **97**, 2025) was applied to a large number of these substances, and it was found that the triketone is a valuable reagent for proteins and their hydrolytic products. The coloration is accompanied by the production of aldehydes, which points to a similarity between triketohydrindene hydrate and alloxan. This is indicated, also, by the formation of a compound which closely resembles alloxantin, and which is called *hydrindantin*. In accordance with the formula of alloxantin (Piloty and Finckh, *Annalen*, 1904, **333**, 68; Slimmer and Stieglitz, *Amer. Chem. J.*, 1904, **31**, 661), the constitution of hydrindantin is represented thus:

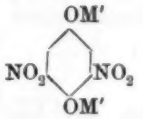
$$C_6H_4\begin{<}{CO\\CO}\end{>}C(OH)\cdot O\cdot CH\begin{<}{CO\\CO}\end{>}C_6H_4.$$

This substance, like alloxantin, is colourless, crystallises with 2 mols. H_2O, and is very sparingly soluble in water; with amino-acids it gives the same coloration as triketohydrindene hydrate. It forms two different sodium salts, according as to whether sodium carbonate or sodium hydroxide is used; one is a dark red salt, and the other is deep blue. With baryta, it yields a blue barium compound, like alloxantin. These salts are decolorised by oxygen. The colourless alkaline solution which is thus formed from hydrindantin contains *o*-carboxymandelic acid. The constitution of these chromo-salts was discussed, and an account was given of the results of the physiological examination of triketohydrindene hydrate.

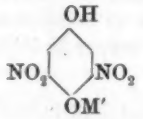
102. "Salts of 3 : 5-dinitroquinol." By William Bayliss Shaw.

It has been found possible to obtain a complete series of the alkali metal salts of 3 : 5-dinitroquinol by adding an alcoholic solution of the metallic hydroxide to an ethereal solution of the free nitro-compound.

The neutral salts (I) are in every case darker in colour than the



(I.)



(II.)

acid salts (II), and the colour deepens progressively from lithium to cæsium as the atomic weights of the metals increase.

The known barium salts have also been investigated, but their properties have not been found to agree with the descriptions given in the literature.

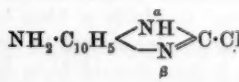
Evidence has been found to support the view that dinitroquinol contains the nitro-groups in the meta-position to one another, and not in the para-position as assumed by Beilstein.

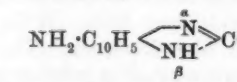
By acting on dinitroquinol with methyl sulphate under suitable conditions the monomethyl ether can be obtained, but the formation of the dimethyl ether by this means does not seem to be possible.

The alkali metal salts of the monomethyl ether have been prepared and investigated.

103. "The question of isomerism between naphthiminazoles." By Raphael Meldola.

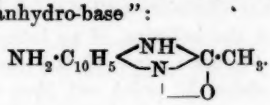
In a series of papers communicated to the Society some years ago by the author in collaboration with various students (*Trans.*, 1899, **75**, 1011; 1900, **77**, 1159; 1903, **83**, 1185; 1904, **85**, 1592), a pair of aminonaphthiminazoles and their derivatives were described, which, according to the evidence obtained, were structurally isomeric in the sense indicated by the formulæ:





If this isomerism really existed, it would have been opposed to the theory of "virtual tautomerism" applied by Otto Fischer to a somewhat parallel case in the benzene series (*Ber.*, 1901, **34**, 4202; *J. pr. Chem*, 1906, [ii], **73**, 423 *et seq.*). In view of this conflict

of evidence, the subject was reinvestigated by this last-named author, who came to the conclusion that one of the supposed isomerides belonged to the series of "oxyiminazoles" first described by St. v. Niementowski (*J. pr. Chem.*, 1907, [ii], **75**, 88). The subject has frequently been referred to since the publication of Fischer's last paper, and has aroused much interest in view of the importance of the theoretical principle involved (see, for example, Pummerer, *Ber.*, 1911, **44**, 343 and 810), and the present author has received several communications inviting an expression of opinion. The facts briefly stated are that dinitro-*a*-aceto-naphthalide when reduced by tin and hydrochloric acid gives a different compound from that which is obtained when the reduction is effected by means of iron and hydrochloric acid (Markfeldt's process). According to Fischer, the base obtained by the first method is an "oxyanhydro-base":



The evidence on which Fischer based this conclusion was mainly derived from the observation that the corresponding naphthiminazole on distillation with iron powder gave the known naphthiminazole (ethenyldiaminonaphthalene) of Prager (*Ber.*, 1885, **18**, 2161). It may be pointed out, as Fischer does not refer to this point, that the author had already recorded the transformation of the aminonaphthiminazole prepared by using tin and hydrochloric acid into Markfeldt's base, by the action of iron and hydrochloric acid (Meldola, Eyre, and Lane, *Trans.*, 1903, **83**, 1200).

As it will be some time before the author can undertake to reinvestigate this subject, he desires to place on record the opinion that Fischer's view of the constitution of the compound prepared by using tin and hydrochloric acid is probably correct, although the method of distilling with iron powder must be regarded as a somewhat violent one when the point to be decided is whether the oxygen in a compound is constitutional or whether it is present in the form of attached water. This is, of course, independent of the question of concordant analytical results, which, in the case of these difficultly combustible compounds, are by no means easy to obtain. The attachment of water to anhydro-bases with varying degrees of pertinacity has long been familiar to workers in this field, and it now appears that many of the iminazoles described by the earlier investigators as containing water of constitution and water of crystallisation may really be "oxyiminazoles." St. v. Niementowski is himself continuing the investigation of the latter

class of compounds (*Ber.*, 1910, **43**, 3012). The present case is certainly remarkable as an instance of the failure of tin and hydrochloric acid to remove the whole of the oxygen where iron and this acid are effective. The mechanism of this reduction is best explained by the assumption that the hydroxylamine phase is passed through as an intermediate stage:

This possibility was frequently considered during the progress of the research, and several unsuccessful attempts were made to arrest the reduction at an intermediate stage. The dinitro-α-acetonaphthalide is extremely insoluble in the usual organic solvents, and the reduction has therefore to be carried on at a temperature too high to admit of the isolation of an intermediate compound.

While accepting Fischer's view of the constitution of the one series, the author wishes to point out that it seems desirable to obtain further confirmation of the "oxyiminazole" formula, as there is reason for believing that the oxygen in this ring may be easily eliminated in unforeseen ways in the course of the reactions to which these compounds may be submitted (see St. v. Niementowski, *Ber.*, 1910, **43**, 3016). Some of the author's results published in the papers referred to, and which are apparently opposed to the "oxyiminazole" formula, may perhaps be explained from this point of view. The azo-derivatives of both the anhydro-bases give well-defined products on complete reduction; they also give rise to very remarkable compounds when acted on by nitrous acid, and to other and also apparently definite products when decomposed by alkali (Meldola and Eynon, *Trans.*, 1900, **77**, 1167, 1169). The study of these various derivatives may throw further light on the question of the constitution of the parent compounds.

104. "The determination of the density of liquids." By Harold Hartley and William Henry Barrett.

The precautions necessary in accurate density determinations involving the use of small quantities of liquid were discussed, and a modified form of pyknometer was described.

105. "The influence of temperature on the basic water value of ethyl alcohol." By William Jacob Jones and Arthur Lapworth.

The authors discussed in detail the theory of Goldschmidt and Udby which led them to suppose that the carriers of catalytic

activity of acids in water and in alcohol are the cations to which the main part of the conductivity of each solution is due.

Measurements were described showing that the basic water value of anhydrous ethyl alcohol varies from about 0·050 at 0° to 0·097 at 25°, the results being nearly the same, whether obtained by determinations of the effect of water on the catalytic activity or on the salt-forming capacity (availability) of dissolved hydrogen chloride.

The heat of the reaction:

$$C_2H_6O,HCl + H_2O = C_2H_6O + H_2O,HCl,$$

in dilute solution was estimated as, roughly, 1100 gram-calories.

106. "Synthesis and resolution of gnoscopine (*dl*-narcotine)." By William Henry Perkin, jun., and Robert Robinson.

A detailed description was given of the synthesis and resolution of gnoscopine, a preliminary account of which has already appeared (*Proc.*, 1910, **26**, 46, 131).

107. "The occurrence of alizarin in rhubarb." By Hugo Müller.

The author has continued his investigations on rhubarb, and finds that the root contains alizarin as well as emodin and chrysophanic acid.

108. "Coumaranone derivatives. Part I." By Richard William Merriman.

Ethyl coumaranonecarboxylate, $C_6H_4<\begin{matrix}--O\\C(OH)\end{matrix}>C\cdot CO_2Et$, the "oxygen" analogue of ethyl indoxylcarboxylate, prepared by internal condensation of ethyl salicylylglycollate (Friedländer, *Ber.*, 1899, **32**, 1868), is not hydrolysed by alkalis, as stated by that author, but forms various well-defined metallic derivatives. The *sodium* and *lead* compounds are colourless, the *silver* derivative is yellowish and unstable, and the *ferric* derivative forms very characteristic, deep blue nodules, soluble in alcohol and ether, but insoluble in water, light petroleum, or benzene. In acetic acid solution, however, the ester, under certain ill-defined conditions, forms a yellow *hydrazone* (needles, m. p. 125—126°), which is hydrolysed normally by acids or alkalis.

With alcoholic phenylhydrazine the action, although smooth, is altogether abnormal, the first tangible product being an azo-

compound, which is apparently formed by oxidation of the hydrazide. *Benzeneazocarbonylcoumaranone*,

$$C_6H_5\cdot N{:}N\cdot CO\cdot CH\!<\!\begin{matrix}O\\CO\end{matrix}\!>\!C_6H_4,$$

forms well-defined, orange needles (m. p. 182—183°); it is readily soluble in alkalis, including ammonia, but it is not hydrolysed by them or by acids; the *silver* derivative is a brick-red powder (m. p. 241°, with decomposition). The *hydrazone* of this azo-compound, resulting from the action of excess of phenylhydrazine under the same conditions, forms ruby-red needles (m. p. 193°), and is not acidic.

Ethyl o-*carboxyphenylglycollate*, $CO_2Et\cdot C_6H_4\cdot O\cdot CH_2\cdot CO_2Et$, hitherto known only in an impure state (Rössing, *Ber.*, 1884, **17**, 2995), was readily prepared in quantity for the above work by the direct interaction of ethyl salicylate and ethyl chloroacetate in presence of sodium ethoxide; it is a heavy, colourless oil (b. p. 190—193°/25 mm.). In addition to the yellow diamide described by Rössing, it forms a colourless *monoamide* (needles, m. p. 165°).

109. "The condensation of acetyl chloride and salicylamide." By Arthur Walsh Titherley and William Longton Hicks.

Acetyl chloride and salicylamide interact immediately in the cold, producing the hydrochlorides of salicylamide and *N*-acetylsalicylamide, the latter evidently by rearrangement of the isomeric *O*-acetyl derivative. By long-continued action of excess of acetyl chloride a white, granular solid is obtained, consisting mainly of a chloro-derivative which with aniline yields *phenylsalicylacetamidine*, $OH\cdot C_6H_4\cdot CO\cdot N{:}CMe\cdot NHPh$. The chloro-derivative gives *N*-acetylsalicylamide immediately on treatment with water, and is probably the impure hydrochloride of the as yet unknown 2-methyl-1 : 3-benzoxazine-4-one, $C_6H_4\!<\!\begin{matrix}CO\cdot N\\ \|\\O\!-\!C\cdot CH_3\end{matrix}$, which has resisted all attempts to isolate it.

This unsaturated cyclic compound should, like its phenyl analogue (Titherley, *Trans.*, 1910, **97**, 204), give a phenylsalicylamidine derivative on treatment with aniline.

The mother liquor from the above granular solid contains O-N-*diacetylsalicylamide*, which, however, is best obtained by pyridine acetylation (using acetic anhydride) of *N*-acetylsalicylamide. The diacetyl derivative is remarkable in being readily soluble in cold water, and in undergoing slow, spontaneous hydrolytic decomposition in air, yielding *N*-acetylsalicylamide.

110. **"The influence of salts on the autofermentation of yeast." (Preliminary note.) By Arthur Harden and Sydney G. Paine.**

It has been found by one of the authors, during an investigation of the permeability of the yeast-cell envelope, that the entrance of such salts as sodium chloride and sodium phosphate is imperceptible when dilute solutions are allowed to act for a short time, and comparatively small even after prolonged immersion of the cells. When, however, more concentrated solutions are employed, an appreciable entrance of the salts is indicated.

These facts, in view of the recent work of H. E. and E. F. Armstrong (*Proc. Roy. Soc.*, 1910, *B*, **82**, 588), therefore suggested the advisability of ascertaining the effect of such salts on the autofermentation of the yeast.

For the experiments here given, top yeast obtained from a London brewery was freed from wort by the simple expedient of pressing, which has been found to give practically quantitative removal of the intersticial liquid; washing was avoided in order that osmotic equilibrium of the cell contents might remain undisturbed.

Three to five grams of such yeast are accurately weighed out for each experiment, wrapped in tissue paper, and dropped into a flask containing a measured quantity of the liquid under investigation, which has previously been saturated with carbon dioxide at 25°. The gas evolved by autofermentation of the yeast is measured periodically by means of the apparatus described by Harden, Thompson, and Young (*Bio.-Chem. J.*, 1910, **5**, 230).

In experiments with sodium chloride and ammonium sulphate it has been found that when these salts are present in decimolar concentration no effect is produced on the autofermentation, but when molar solutions are employed the rate of fermentation is very considerably enhanced during the first four or five hours, so that the volume of carbon dioxide yielded in presence of the salt is three times as great as that given by a water control. At this point, however, the autofermentation in the former case comes abruptly to an end, and eventually after four or five days the volume of gas given in the two cases is approximately the same.

A similar result has also been obtained with a number of other salts, including phosphates, arsenates, acetates, and citrates.

In a recent paper by C. Neuberg and A. Hildesheimer (*Biochem. Zeitsch.*, 1911, **31**, 170) it is stated that salts of pyruvic acid are fermentable by yeast, and that this property is also exhibited by salts of glyceric and lactic acids. Similar experiments have been carried out with these salts, and these have shown that the two

latter give precisely the same phenomenon as was found in the case of sodium chloride, whilst with potassium pyruvate the rate of fermentation during the first four hours is exactly comparable with that in a sodium chloride control. At this point, however, the fermentation in presence of the latter salt slackens, while the evolution of gas from the pyruvate solution continues and only gradually diminishes. Eventually after four days some 60 c.c. of carbon dioxide are yielded in presence of 2·4 grams of potassium pyruvate in excess of the volume given by the control.

The provisional conclusion of Neuberg and Hildesheimer that these salts undergo fermentation by yeast cannot, therefore, be accepted until experimental proof is forthcoming that the carbon dioxide is actually derived from them, and not from the constituents of the yeast.

The increase in the rate of autofermentation produced by the addition of salts to living yeast may be explicable on the lines suggested by H. E. and E. F. Armstrong, or it may be that, as a result of plasmolysis of the cells, the glycogen is thrown into more intimate contact with the glycogenase.

The acceleration does not appear to be due to a stimulating influence on the glycogenase, since when added to yeast juice in equivalent concentration sodium chloride tends to inhibit, rather than to enhance, the rate of autofermentation.

111. "Preparation of secondary amines from carboxylic acids. Part II. Preparation of the heptadecyl and pentadecyl derivatives of α- and β-naphthylamine." By Henry Rondel Le Sueur.

The higher alkyl derivatives of both α- and β-naphthylamine are readily obtained by heating the corresponding naphthylamino-acid. Thus, *heptadecyl-α-naphthylamine*, $C_{17}H_{35}\cdot NH\cdot C_{10}H_7$, and carbon dioxide are produced when *α-1-naphthylaminostearic acid*,

$$C_{16}H_{33}\cdot CH(NH\cdot C_{10}H_7)\cdot CO_2H,$$

is rapidly heated above its melting point.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Bingham, *Eugene C.*, and **White,** *George F.* Laboratory manual of inorganic chemistry. pp. viii + 146. New York 1911. (*Recd.* 1/4/11.)
From the Publishers: Messrs. John Wiley and Sons.

International Congress of Applied Chemistry, VII. London, 1909. [Proceedings, etc.] 18 vols. London 1910. (*Reference*).
From the Committee.

Lunge, *George.* The manufacture of sulphuric acid and alkali, with the collateral branches. Vol. III. Ammonia-soda, various processes of alkali making and the chlorine industry. 3rd edition. pp. xix + 764. London 1911. (*Recd.* 21/3/11.) From the Author.

Winterstein, *Ernst,* and **Trier,** *Georg.* Die Alkaloide. pp. vii + 340. Berlin 1910. (*Recd.* 24/3/11.)

II. *By Purchase.*

Carnot, *Adolphe.* Traité d'analyse des substances minérales. Vol. III. pp. 903. Paris 1910. (*Recd.* 23/3/11.)

Desch, *Cecil Henry.* Chemistry and testing of cement. pp. xi + 287. ill. London 1911. (*Recd.* 21/3/11.)

Jörgensen, *Alfred.* Micro-organisms and fermentation. Translated by *Samuel Henry* **Davies.** 4th edition. pp. xi + 489. London 1911. (*Recd.* 21/3/11.)

ERRATA.

1911, p. 57, line 19, *for* "**Part XVI**" *read* "**Part XVII.**"
—— p. 64, ,, 17, ,, "Leeds" *read* "Bradford."

At the next Ordinary Scientific Meeting on **Thursday,** May **4th, 1911,** at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"The constituents of bryony root." By F. B. Power and C. W. Moore.

"Note on the action of hydrogen dioxide on thiobenzanilide." By H. Leete and E. de B. Barnett.

"Purification of acetic acid." By K. J. P. Orton, Miss M. G. Edwards, and H. King.

"The detection and estimation of small quantities of acetic anhydride in acetic acid." By Miss M. G. Edwards and K. J. P. Orton.

"Tetramethylammonium hyponitrite and its decomposition by heat." By P. C. Ray and H. K. Sen.

"Reactivity of the halogens in organic compounds. Part VI. The mechanism of negative catalysis." By G. Senter and A. W. Porter.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, May 4th, 1911.

Auld, Samuel James Manson,

65, Margery Park Road, Forest Gate, E.

Research Chemist. D.Sc. (Lond.); Ph.D. (Würzburg); F.I.C. For six years on the staff of the Scientific and Technical Dept. of the Imperial Institute. Recently appointed Lecturer in Chemistry and Head of the Chemical Dept., South Eastern Agricultural College. Author, or joint author, of twenty-five communications to *Journ. Chem. Soc.*, *Journ. Soc. Chem. Ind.*, *Proc. Roy. Soc.*, etc.

Wyndham R. Dunstan.	Sam. S. Pickles.
J. T. Hewitt.	M. O. Forster.

Arthur W. Crossley.

Bennison, Ernest Carr,

4, Sir John's Road, Selly Park, Birmingham.

Pharmaceutical Chemist. Mem. Inst. Hygiene. Late assistant with Mr. A. Braithwaite, F.I.C., etc., Laboratories, S. Durham Iron Co.; also with Messrs. Brady and Martin, Manufacturing Chemists, Newcastle-on-Tyne. Late Lecturer on Materia Medica and Pharmacy, Middlesbro' Science School and Darlington Technical College. Lecturer Inst. Hygiene, "Radium and Radio-activity," 1909–1910. Admitted to instruction in Radium Institute, Paris, 1908. Lectured on "Radium," Mid. Phar. Assoc., 1910, and "Physiological Action of Formic Acid in Insect Bites," *Ph. J.*, 1907, etc.

J. Archyll Jones.	Alfred Southall.
Frederick Doyle.	*Gilbert Palmer.*
J. Frederick Alder.	*J. W. Patterson.*

Bowden, Richard Charles,

21, Rokeby Avenue, Redland, Bristol.

Science and Mathematic Master. Author of "Studies on the Constitution of Soaps in Solution; Electrical Conductivity of Sodium Stearate Solutions," before Chemical Society, Jan. 19th, 1911 (*Trans. J.C.S.*, February, 1911). B.Sc. (Honours in Chemistry), University of Bristol. Assoc. M.V.T.C., Bristol.

J. Wertheimer. Francis Francis.
F. W. Rixon. *Herbert J. Taylor.*
Robert Gawler.

Bowyer, Arthur Stewart,

The Woodlands, Chelford, Cheshire.

Analytical Chemist, Messrs. Chas. Lowe & Co., Manufacturers of Pure Phenol, etc. Three years student in the Chemical Laboratories, University of Manchester; one year research student. B.Sc. Hons. in Chemistry; M.Sc.

Harold B. Dixon. E. C. Edgar.
W. H. Perkin. Ch. Weizmann.
A. Lapworth. R. Robinson.
Alfred Holt.

Collington, John Eric,

Claremont, Noel Road, Edgbaston.

Analytical Chemist. Have held the position of Chief Assistant in the Laboratory of the Public Analyst for the County Borough of Smethwick for two years.

Arthur Adams. H. S. Shorthouse.
Harry Silvester. William Duncan.
W. Waters Butler.

Crook, Clement Arthur,

4, Dry Clough Lane, Halifax.

Foreman Dyer and Lecturer in Cotton, Wool, and Silk Dyeing. Honours Certificates in Cotton, Wool, and Silk Dyeing (City and Guilds). Lecturer, as above, at Halifax Technical College. Foreman Dyer in yarn aud slubbing dyehouse.

E. W. Smith. R. Lyon.
Wm. Cranfield. *T. Luxton.*
J. Wilkinson.

Crymble, Cecil Reginald,

7, Upper Crescent, Belfast.

Chemist. B.Sc. (R.U.I.). Assistant in Chemical Department,

Queen's University, Belfast, until 1910. 1851 Exhibition Research Scholar. Publications: "Studien über Absorptions Spektren, Parts I.—III.," with Dr. Stewart and R. Wright.

E. A. Letts. John Hawthorne.
Robert F. Blake. A. W. Stewart.

Samuel Smiles.

Dickinson, William Henry,
Bombay.

Captain, Indian Medical Service. Chemical Analyser to Government, Bombay, and Professor of Chemistry, Grant Medical College, Bombay. M.B., Ch.B. (Edin.). F.I.C.

H. Droop Richmond. Patrick H. Kirkaldy.
John M. Thomson. Herbert Jackson.

Cecil H. Cribb.

Douse, Oliver Statham,
Fern Bank, Glossop.

Research Student in Chemistry. Four years in the Chemical Laboratories of the Manchester University. B.Sc. with Honours in Chemistry. Assistant in Research Laboratory.

Harold B. Dixon. E. C. Edgar.
W. H. Perkin. Ch. Weizmann.
A. Lapworth. R. Robinson.

Alfred Holt.

Eggington, Alfred Thomas,
The Hawthorns, Ibstock, near Leicester.

Student at Royal College of Science, South Kensington. About to take post as Science Master, Borlase School, Great Marlow. National Scholarship in Chemistry, 1907, and, subsequently, four years at Royal College of Science, South Kensington. Associate of Royal College of Science in Chemistry, 1910, London. B.Sc., 1910, with Third Class Honours in Chemistry. Post-graduate work—chiefly inorganic analytical chemistry.

T. E. Thorpe. James C. Philip.
M. O. Forster. G. T. Morgan.

Chapman Jones.

Eldridge, Arthur Alfred,
School House, Alpha Road, Surbiton Hill.

Student. Associate of King's College, London, in the Faculty of Science. Bachelor of Science (London), with Third Class Honours in Chemistry. For four years student at King's College, London. At

present Government Student at the Royal College of Science (Imperial College of Science and Technology). Formerly Student Demonstrator in Chemistry at King's College.

John M. Thomson. T. E. Thorpe.
Herbert Jackson. M. O. Forster.
Patrick H. Kirkaldy. G. T. Morgan.

Elkington, John Algernon,
26, Rye Hill Park, S.E.

Analytical Chemist, Government Laboratory. Late Student at Royal College of Science. Passed all examinations in the full chemical course at that College (Organic and Inorganic). Passed entrance examination to Government Laboratory in Chemistry (Organic and Inorganic), Physics and Mathematics (taking first place). Since 1906 employed in Chemical Analytical work at the Government Laboratory.

M. O. Forster. G. T. Morgan.
James C. Philip. Chapman Jones.
W. Godden.

Empson, Alfred Walker, A.M.I.E.E., A.M.I.Mech.E.,
Calcutta, India.

General Manager of the Cast Iron Brazing Syndicate, 174, Dhunumtollah Street, Calcutta. For some time a pupil of Mr. A. E. Bell, F.I.C., F.C.S. Have specialised in water and boiler scale analysis, upon which subjects I have contributed several articles to the technical press. Am carrying out all the analytical work in connexion with some borings now being made in Assam for oil. My reason for wishing to join the Society is that I want to keep in touch with the latest developments in Chemical Science.

Albert E. Bell. Frank H. Wall.
Joseph H. Williams. *H. Sampson Wills.*
T. W. Firth Clark.

Enfield, Ralph Roscoe, B.A.,
Toynbee Hall, Commercial Street, E.

Chemist at Tar and Liquor Works, Gas Light & Coke Co., Beckton. Late Scholar and Dixon Research Scholar of Christ Church, Oxford, and Assistant Demonstrator at the University Laboratories, Cambridge. Author of "The Reduction of Chloric Acid," *J.C.S.*, Trans., 1910.

Henry E. Roscoe. H. J. H. Fenton.
William J. Pope. H. B. Baker.
T. Wilton.

Harwood, Henry Francis,

Erlesdene, Park Road, Hale, Cheshire.

Demonstrator of Chemistry at the Royal College of Science; M.Sc. of Manchester University; Ph.D. of Heidelberg University. Author of "Die Analyse von Vanadinverbindungen mittels Tetrachlorkohlenstoff."

Harold B. Dixon.	E. C. Edgar.
W. H. Perkin.	Ch. Weizmann.
A. Lapworth.	R. Robinson.

Alfred Holt.

Hughes, Edwin Burnhope,

5, Perham Road, West Kensington, W.

Tutor in Chemistry and Physics at The General Engineering College, Earl's Court, S.W. Six years' experience in teaching Chemistry; educated at Rutherford College, Newcastle-on-Tyne. Reading for Final B.Sc. next October; at present Inter.B.Sc. (1907). Intend to devote myself to Physical Chemistry, and to conduct research, for which I have plans, after Final B.Sc. I wish to enter the Chemical Society in order to keep in touch with advances of Chemistry, etc., and for use of library.

F. Frankland Armstrong.	John Gibson.
J. Vargas Eyre.	*Edward Horton.*
W. Robertson.	*Fredk. P. Worley.*

Lucas, Thomas Riley,

No. 3 Cantonments, Vizianagram, Madras (Pres.), India.

Manager and Chemist for Bobbili Mining Co., Ltd., Vizianagram. Associate of City and Guilds Institute. Chemist to Allen's Public Laboratory, Sheffield. Works Chemist, Associated Portland Cement Manufacturers, Gravesend and Grays. Chemist to Bobbili Mining Co., Ltd.

Henry E. Armstrong.	E. Horton.
Gerald T. Moody.	T. M. Lowry.
W. Robertson.	*J. V. Eyre.*

Messervy, Roney Forshaw,

73, Blenheim Crescent, W.

Chemist. Continuously engaged for the past two years in Technical and Chemical Research Work in the laboratory of Mr. L. A. Levy,

M.A., B.Sc., A.I.C., F.C.S. Other reasons: (i) I desire to have the use of the Library. (ii) To receive the Society's publications.

Leonard A. Levy. *H. O. Jones.*
W. H. Gibson. *F. E. E. Lamplough.*
Alfred C. G. Egerton. *F. W. Dootson.*
H. J. H. Fenton. *F. W. Toms.*

Moullin, Oswald Mansell-,
69, Wimpole Street, London, W.

B.A., King's College, Cambridge. Science Master at Dover College.

William Ramsay. Alfred Lloyd.
Charles T. Heycock. J. K. H. Inglis.
H. O. Jones.

Newton, Leonard Owen,
St. Elba, Napoleon Rd., St. Margarets-on-Thames.

Analytical Chemist. Educ. "Tiffins," Kingston. Pass Cert.: Cambridge Local, Theoretical and Practical Chemistry, etc.; 3 years student at Sir John Cass Technical Institute, Theoretical and Practical Inorganic and Physical Chemistry; 6 years Asst. Manager and Analyst to The "Locomobile" Co., London; at present Analyst to Messrs. Lassen and Hjort, Water Purification Specialists, 52, Queen Victoria St., London., with whom I have been for 5 years.

Charles A. Keane. C. F. Townsend.
H. Burrows. *Thos. Macara.*
Henry Bailey.

Owen, Idris Larkby,
101, Floyer Road, Small Heath, Birmingham.

Senior Science Master, Council Secondary School, Waverley Rd., Birmingham. 1900–1903, Science Master, Technical Institute, King's Lynn. 1903, Responsible for teaching of Chemistry in above School. 1905, M.Sc. (Chemistry), Liverpool University. Student Liverpool University 3 years. Technical School, Birmingham, 3 years.

T. Slater Price. *Hamilton McCombie.*
Douglas F. Twiss. *Thos. J. Murray.*
A. W. Titherley. *C. K. Tinkler.*
Charles A. Keane. *Edgar P. Hedley.*
J. E. Coates.

Pastfield, John Lawrence Robinson, B.A., Oxon.,
"Olivedale," St. Thomas, Exeter.
Student. Second Class Honours, Chemistry, Oxford, 1910.

Andrea Angel.	F. D. Chattaway.
H. B. Baker.	John Watts.

J. E. Marsh.

Penney, Richard Garnet,
40, Duesbery Street, Hull.
Analytical Assistant. Since September, 1902, to the present time, Assistant to Mr. M. D. Penney, Analyst, 11, High St., Hull.

M. D. Penney.	Harry Thompson.
F. W. Richardson.	*T. L. Patterson.*

Arnold R. Tankard.

Percival, George Arncliffe,
34, Cartwright Gardens, London, W.C.
Metallurgical Chemist, Birmingham Technical School. Metallurgist at Kynoch's; Assistant Analyst to Mr. A. E. Tucker, F.I.C.; now works chemist, Cowper-Coles Engineering Co., Ltd.; particularly interested in rare earths and extraction.

Lionel M. Jones.	*T. Slater Price.*
Hamilton Wingate.	*J. S. S. Brame.*
Leonard A. Levy.	*Charles A. Keane.*

Rivett, Albert Cherbury David,
Chemistry Department, University, Melbourne, Australia.
Assistant Lecturer and Demonstrator. B.A. (Oxon.), B.Sc. (Melb.). Has studied in Melbourne, Oxford, and Stockholm. Has published in the Society's Transactions.

Orme Masson.	Harold Hartley.
James Walker.	N. V. Sidgwick.
Svante Arrhenius.	William Odling.

Robison, Robert,
227, Woodborough Road, Nottingham.
Lecturer and Demonstrator in Chemistry at University College, Nottingham. Ph.D. (Leipzig), B.Sc. (London), F.I.C. Formerly Assistant Lecturer and Demonstrator in Chemistry at University College, Galway. Author of "Über die polychromen Salze aus Dimethyl- und Diphenyl-Violursäure" (Leipzig, 1909); also, conjointly with Prof. Kipping, "Organic Derivatives of Silicon," *J.C.S.*, **93**, 439, and,

conjointly with Prof. Hantzsch, "Über die pantochromen Dimethyl- und Diphenyl-violurate," *Ber.*, **43**, 45; "Notiz über Purpursäure," *Ber.*, **43**, 92.

F. Stanley Kipping. Henry J. S. Sand.
R. M. Caven. J. Lister.
Oliver Quibell.

Walker, Eric Everard,
210, Bedford Hill, Balham.

Student. Advanced Student of Chemistry, City and Guilds of London Central Technical College.

Henry E. Armstrong. J. Vargas Eyre.
W. Robertson. T. Martin Lowry.
Edward Horton.

Watson, Henry Hough,
Braystones, *viâ* Carnforth.

Assistant to Mr. W. H. Watson, F.C.S., F.G.S., Analytical Chemist. Chemical research, especially in connexion with agriculture and bacteriology.

William Thomson. *James Porter Shenton.*
Robert Hellon. *J. Carter Bell.*
George Dixon. *C. Estcourt.*
C. H. H. Walker. *Alex. K. Miller.*
W. H. Watson. *Chas. Turner.*

Wilks, William Arthur Reginald,
50, Stowheath Lane, Priestfield, Wolverhampton.

Assistant Demonstrator in Chemistry. M.A. and Fellow of Gonville and Caius College. Published (with Dr. Fenton): "Isoiminazolone" (*J.C.S.*, Trans., 1909, 1329).

W. J. Sell. W. J. Pope.
C. S. Gibson. F. W. Dootson.
H. J. H. Fenton.

Wood, William,
"Katoomba," King Edward Avenue, Dartford.

Pharmaceutical Chemist on staff of the Wellcome Chemical Works, Dartford, for fourteen years. Major qualification of Pharmaceutical Society of Great Britain. Student in the school of the Pharmaceutical Society, 1887–8.

Wyndham R. Dunstan. Francis H. Carr.
H. A. D. Jowett. John Attfield.
E. F. Harrison.

Wright, Robert,
Lauriston, Derrysolgie Avenue, Belfast.

Assistant in Chemistry, Queen's University, Belfast. Graduate (M.A.) of R.U.I. Assistant in Queen's University, Belfast, since 1909. Publications: "Studien über Absorptions Spektren, I.—III.," with Dr. Stewart and C. R. Crymble.

E. A. Letts. — John Hawthorne.
Robert F. Blake. — A. W. Stewart.
Samuel Smiles.

The following Certificates have been authorised by the Council for presentation to Ballot, under Bye-law I. (3):

Adendorff, John Ernest Roux,
Randfontein, Transvaal.

Analytical Chemist, Assayer, and Metallurgist. Studied Chemistry, theoretical and practical, for three years (1900–1903) under Dr. P. D. Hahn, Ph.D., M.A., of the S. African College, Cape Town. Served two years as Chemical Assistant in the Government Laboratories, Cape Town (1903–1905). Was Chief Assayer for ten months to Randfontein South Gold Mining Co. (1907–1908). Am Chief Chemist to the Robinson Group of Companies, Witwatersrand, Transvaal (1908). (1) Have investigated into cause of formation of "white precipitate" in zinc precipitation boxes from gold bearing solutions. (2) Experimented as to rate of solubility by aëration in "Pachnea" tanks of the gold in the Rand ore, using weak cyanide solution.

J. Müller. — John G. Rose.
E. V. Flack. — J. McCrae.

Datta, Atulchandra, M.A.,
Bag Mozaffar Khan, Agra.

Senior Professor of Science, St. John's College, Agra. Took the M.A. Degree of the Calcutta University in Physical Science in 1892, and serving as a Professor of Physics and Chemistry for about fifteen years. Written the following books: (1) "Aids to the study of Science for B.A. Students"; (2) "University Papers on Chemistry;" (3) "Lecture Notes on Inorganic Chemistry;" (4) In the press: "Wave Motion and Sound, for the B.Sc. Students." Desires admission to keep in touch with recent chemical investigations, etc., etc.

Tarak Nath Das. — *Ram Chandra Mukerjee.*
Bidhu Bhusan Dutta — *Gopal C Banerjee.*
T. K. Buxy.

Giddy, Thomas Grantham,

High Street, Newcastle, New South Wales, Australia.

Science Master. Associate of Sydney Technical College in Metallurgy and Assaying (which included full courses in Theoretical and Analytical Chemistry). For several years Honorary Assistant Science Master at Newcastle (N.S.W.) Technical College. Formerly acted as Science Master at Newcastle and East Maitland High Schools, as Lecturer in Chemistry at Maitland Technical College, and at present as Science Master at Newcastle Technical College and School of Mines, lecturing in Chemistry (Theoretical and Analytical) and Assaying.

Albert J. Sach. Henry G. Smith.

Wheldon, Alfred Henry Finniss-,

446, Currie Road, Durban, Natal, South Africa.

Student [completing Course of Chemistry and Chemical Technology with the International Correspondence Schools, Ltd. (London)]. I wish to keep in touch with the science of Chemistry, in which I am very much interested. I have a private laboratory to enable me to undertake analytical work.

W. T. A. Edwards. *James A. H. Armstrong.*

L. Ernest Rouillard. *Hamilton Wingate.*

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 15/5/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 386.

Thursday, May 4th, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. J. Bate and R. Hurst were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Arthur Owen Blackhurst, Downing, Broughton, Preston.
Ganesh Datta, B.A., Dera Ismail Khan, N.W.F.P., India.
Joges Chandra Ghose, M.A., Bhagalpur, Behar, India.
Herbert James Ling, Hankow, China.
Felix Gabriel Paul, No. 64, 38th Street, Rangoon, Burma.
William Keighley Walton, Beechwood, Upper Rushton Road, Thornbury, Bradford.

The PRESIDENT announced that a general discussion on the subject of "High Temperatures" would take place at a meeting of the Faraday Society to be held on Tuesday, May 23rd, 1911.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected:

John Ernest Roux Adendorff.
Samuel James Manson Auld, D.Sc., Ph.D.
Ernest Carr Bennison.
Richard Charles Bowden, B.Sc.
Arthur Stewart Bowyer, M.Sc.
John Eric Collington.
Clement Arthur Crook.
Cecil Reginald Crymble, B.Sc.

Atulchandra Datta, M.A.
William Henry Dickinson, M.B., Ch.B.
Oliver Statham Douse, B.Sc.
Alfred Thomas Eggington, B.Sc.
Arthur Alfred Eldridge, B.Sc.
Algernon John Elkington.
Alfred Walker Empson.
Ralph Roscoe Enfield, B.A.
Thomas Grantham Giddy.
Henry Francis Harwood, M.Sc., Ph.D.
Edwin Burnhope Hughes.
Thomas Riley Lucas.
Roney Forshaw Messervy.
Oswald Mansell-Moullin, B.A.
Leonard Owen Newton.
Idris Larkby Owen, M.Sc.
John Lawrence Robinson Pastfield, B.A.
Richard Garnet Penny.
George Arncliffe Percival.
Albert Cherbury David Rivett, B.A., B.Sc.
Robert Robison, Ph.D., B.Sc.
Eric Everard Walker.
Henry Hough Watson.
Alfred Henry Finniss-Wheldon.
William Arthur Reginald Wilks, M.A.
William Wood.
Robert Wright, M.A.

Of the following papers, those marked * were read:

*112. "The constituents of bryony root."
By Frederick Belding Power and Charles Watson Moore.

The material employed for this investigation consisted of the freshly collected roots of *Bryonia dioica*, Linné.

The roots were found to contain an enzyme, which was obtained in the form of a light brown powder. This product slowly hydrolysed the glucosidic constituent of the root, and also effected the hydrolysis of amygdalin and salicin.

An alcoholic extract of the root, when distilled in steam, yielded a small amount of a pale yellow essential oil. From the portion of the extract which was soluble in water, and contained a quantity of sugar, there were isolated: (i) a colourless, neutral *substance* (m. p. 220—222°), which appears to possess the formula $C_{20}H_{30}O_5$, and has $[\alpha]_D + 58{\cdot}6°$; (ii) an amorphous glucosidic product, having a bitter taste, which, on hydrolysis, yielded a brown resin and a sugar, from which *d*-phenylglucosazone (m. p. 208—210°) was prepared; (iii) an amorphous alkaloidal principle, possessing an intensely bitter taste, which was apparently incapable of forming any crystalline salt.

The portion of extract which was insoluble in water consisted of a dark brown, viscid resin, amounting to about 2 per cent. of the weight of dried root employed. From this material the following compounds were isolated: (i) a phytosterol, $C_{27}H_{46}O$ (m. p. 137°), which was optically inactive; (ii) a new dihydric alcohol, *bryonol*, $C_{22}H_{34}O_2(OH)_2$, melting at 210—212°, and yielding a *diacetyl* derivative, melting at 152°. Bryonol belongs to a group of dihydric alcohols possessing the general formula $C_nH_{2n-8}O_4$, which comprises the following additional compounds: ipurganol, $C_{21}H_{32}O_2(OH)_2$;

grindelol, $C_{23}H_{36}O_2(OH)_2$; and cucurbitol, $C_{24}H_{38}O_2(OH)_2$; (iii) oleic, linolic, palmitic, and stearic acids.

The activity of the root appears to reside chiefly in its resinous and alkaloidal constituents, and the so-called "bryonin" of previous investigators has been shown to consist of a complex mixture, which was not entirely glucosidic.

***113. "Reactivity of the halogens in organic compounds. Part VI. The mechanism of negative catalysis." By George Senter and Alfred William Porter.**

The kinetics of the reaction of silver nitrate with bromoacetic and α-bromopropionic acids respectively in absolute ethyl alcohol have been measured at 49·9°. The reactions are retarded by nitric acid to an even greater extent than in aqueous solution. A formula which represents the results fairly satisfactorily was given.

A formula which represents accurately the decomposition of α-bromopropionic acid by water has been derived on the assumption that both the anions and the non-ionised acid react with water.

It was shown that the usual formula which represents negative catalysis as a difference between two factors is not in accord with the available experimental data. An empirical formula, based on the assumption that the rate of reaction is inversely proportional to the concentration of the negative catalyst, was shown to represent the experimental results very closely. The mode in which accurate formulæ representing negative catalysis may be derived was indicated, and the connexion between the accurate and the empirical formulæ pointed out.

***114. "The constitution of scopoletin." By Charles Watson Moore.**

Scopoletin, a fluorescent substance obtained from *Scopolia japonica* and several other plants, has been shown to be 4-hydroxy-5-methoxycoumarin, since by prolonged boiling with aqueous potassium hydroxide it is converted into 2:4-dihydroxyanisole. When, however, the alkali hydroxide is allowed to act for a few minutes only on scopoletin, 2:4-*dihydroxy*-5-*methoxycinnamic acid* is formed. In connexion with the investigation, the following compounds have also been prepared and characterised: 2:4-*Diacetoxyanisole* (m. p. 62—64°); 2:5-*diacetoxyanisole* (m. p. 94°); 2:4:5-*trimethoxycinnamic acid* (m. p. 163—165°); 2:4-*dihydroxy*-5-*methoxy*-β-*phenylpropionic acid* (m. p. 69°); the *lactone* of 2:4-*dihydroxy*-5-*methoxy*-β-*phenylpropionic acid* (m. p. 155°); the *lactone* of 2-*hydroxy*-4-*acetoxy*-5-*methoxy*-β-*phenylpropionic acid*

(m. p. 135°); 2:4:5-*trimethoxy-β-phenylpropionic acid* (m. p. 96°); and *methyl* 2:4:5-*trimethoxy-β-phenylpropionate* (m. p. 54°).

115. "Note on the action of hydrogen dioxide on thiobenzanilide." By Harold Leete and Edward de Barry Barnett.

It has been shown previously (Jacobson, *Ber.*, 1886, **19**, 1068) that 1-phenylbenzothiazole is produced when thiobenzanilide is oxidised in alkaline solution with potassium ferricyanide. The authors now find that when the oxidation is brought about by hydrogen dioxide in alkaline solution, sulphur is eliminated as sulphuric acid, and benzanilide is formed. In neutral solution, however, a compound, $C_{13}H_{11}ONS$, is also formed, and this is the sole product when the oxidation takes place in acid solution. As a similar product is not obtained from benzanilide, it would seem that the oxygen is taken up by the sulphur atom, and this receives confirmation from the insolubility of the substance in alkali. No sulphinic acid appears to be formed, as is the case when hydrogen dioxide acts on thiocarbamide in neutral or alkaline solution (Barnett, *Trans.*, 1910, **97**, 63). In order to bring about the oxidation, the thiobenzanilide (20 grams) was dissolved in alcohol or acetone, a few c.c. of dilute sulphuric acid added, and then 20 grams of a 30 per cent. aqueous solution of hydrogen dioxide. Considerable heat was evolved, and on cooling the oxidation product separated out. This was crystallised from alcohol, and dried in a vacuum over concentrated sulphuric acid:

0·2140 gave 0·5322 CO_2 and 0·0958 H_2O. C = 67·8; H = 4·93.
0·3252 „ 17·2 c.c. N_2 at 17° and 746 mm. N = 6·02.
0·3042 „ 0·3118 $BaSO_4$. S = 14·07.
0·1544 in 15·4 naphthalene gave $\Delta t = -0·325°$. M.W. = 216.

$C_{13}H_{11}ONS$ requires C = 68·1; H = 4·80; N = 6·11; S = 13·97 per cent. M.W. = 229.

Thiobenzanilide oxide forms pale yellow, microscopic needles, which, when rapidly heated, melt at 162—163°, but decompose at a considerably lower temperature on prolonged heating. It is readily soluble in hot alcohol or benzene, or in warm aniline or nitrobenzene, but is insoluble in water or ether.

116. "Purification of acetic acid." By Kennedy Joseph Previté Orton, Muriel Gwendolen Edwards, and Harold King.

Chlorine and bromine do not react with pure acetic acid when light is excluded. Fall in the titre of a solution of bromine in

acetic acid, especially if diluted, shows the presence of certain impurities, which are found in the majority of commercial acetic acids. Both fractional distillation and fractional freezing give but small proportions of pure acetic acid.

Distillation from phosphoric oxide, on the other hand, yields 85—90 per cent. of the acid free from these impurities. With the proper precautions only traces, 0·009—0·04 per cent., of acetic anhydride are produced in this treatment.

117. "**The detection and estimation of small quantities of acetic anhydride in acetic acid.**" **By Muriel Gwendolen Edwards and Kennedy Joseph Previté Orton.**

A method of detecting and estimating small quantities of acetic anhydride in aqueous acetic acids was described. The method is based on the fact that certain anilines, notably 2:4-dichloroaniline, react with acetic anhydride with great rapidity. The anilide can be separated accurately from the aniline, and then indirectly estimated in the form of chloroamine.

118. **Tetramethylammonium hyponitrite and its decomposition by heat.**" **By Prafulla Chandra Rây and Hemendra Kumar Sen.**

A solution of tetramethylammonium hyponitrite when evaporated in a vacuum over sulphuric acid undergoes partial hydrolysis, resulting in the formation of a basic hyponitrite of the quaternary base.

Nitrous oxide, trimethylamine, nitrogen, and methyl ether are the gaseous products of decomposition of tetramethylammonium hyponitrite; a small fraction of the hyponitrite is also converted into nitrate.

119. "**The second and third dissociation constants of orthophosphoric acid.**" **By Edmund Brydges Rudhall Prideaux.**

A complete account of the changes in hydrogen ion concentration during the neutralisation of the second and third hydrogen ions of orthophosphoric acid has been prepared, partly from the measurements of Salm (*Zeitsch. physikal. Chem.*, 1907, **57**, 492), and partly from new results. The former results were checked by preparing the solutions in a different way. Equations have been deduced

connecting the hydrogen ion concentration of salts of weak polybasic acids with the dissociation constants of these acids.

The second and third dissociation constants of orthophosphoric acid as found by Abbott and Bray (*J. Amer. Chem. Soc.*, 1909, **31**, 730) have been tested by means of these results and equations.

The value $k_2 = 2{\cdot}0 \times 10^{-7}$ has been confirmed, but instead of $k_3 = 3{\cdot}6 \times 10^{-13}$, $k_3 = 3{\cdot}0 \times 10^{-12}$ should be substituted as a result of the present work. The revised constants have been used to construct a general equation which it is hoped will be useful to all who require the standards in question.

120. "Experiments on tautomerism. Part I. The tautomerism of the system X·CHR·CR:CR·X, showing the identity of the α- and γ-positions in the glutaconic acid molecule." By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

The elimination of a carbethoxy-group as ethyl carbonate in several instances already published has led to the general conclusion that when the terminal hydrogen atoms in systems of the above type are all replaced the tendency for the compound to acquire the hydrogen atom necessary to enable it to react in its tautomeric form is such that any group capable of replacement by hydrogen is at once eliminated in the presence of a suitable reagent. Numerous experiments in support of this view were described.

It was also shown that α-methylglutaconic acid,

$$CO_2H{\cdot}CHMe{\cdot}CH{:}CH{\cdot}CO_2H,$$

and γ-methylglutaconic acid, $CO_2H{\cdot}CH_2{\cdot}CH{:}CMe{\cdot}CO_2H$, are identical, as are also α-methyl-γ-ethylglutaconic acid,

$$CO_2H{\cdot}CHMe{\cdot}CH{:}CEt{\cdot}CO_2H,$$

and γ-methyl-α-ethylglutaconic acid, $CO_2H{\cdot}CHEt{\cdot}CH{:}CMe{\cdot}CO_2H$.

It was suggested that the cause of the identity of the α- and γ-positions in the molecule of glutaconic acid is of the same order as that determining the equality of the meta-positions in the benzene ring.

121. "Nitrites of the alkylammonium bases: ethylammonium nitrite, dimethylammonium nitrite, and trimethylammonium nitrite." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

These nitrites are prepared by the interaction of silver nitrite and the corresponding amine hydrochloride. Ethylammonium nitrite, when heated, decomposes according to the equation

$$2NEtH_3{\cdot}NO_2 = N_2 + 3H_2O + NEt_2{\cdot}NO.$$

Dimethylammonium nitrite is mainly converted into nitrosodimethylamine, and the decomposition of trimethylammonium nitrite is represented by the equation:

$$3NMe_3H\cdot NO_2 = NMe_3H\cdot NO_3 + 2NO + 2NMe_2 + H_2O.$$

122. **"The relation of position isomerism to optical activity. Part IX. The rotation of the menthyl esters of the isomeric fluoro- and iodo-benzoic acids and of the halogen derivatives of the fatty acids."** **By Julius Berend Cohen.**

In a former paper the apparently anomalous optical relation of the ortho-, meta-, and para-iodobenzoic esters was referred to, and in view of the important effect of temperature, to which attention was drawn, it was decided to re-investigate the rotation of these three compounds (previously determined at 20°) at higher temperatures. This has now been done, and the temperature-rotation curves have been plotted at 20° intervals up to 100°. At 20° the rotations of the three isomerides are identical, $[\alpha]_D$ −61·5°, whilst at 100° there is a slight diminution in the case of the ortho-isomeride, $[\alpha]_D$ −61·2°, which is greater in the case of the meta-, $[\alpha]_D$ −60·4°, and greatest in that of the para-, $[\alpha]_D$ −58°.

The three menthyl fluorobenzoates show among themselves a similar relation to that observed among the chlorine and bromine derivatives, the molecular rotations at 20° of the halogen derivatives being as follows:

Menthyl ester.	F.	Cl.	Br.	I.
Ortho	−194·5	−195	−205	−237
Meta.....	236	237	239	237
Para...	239	237	239	237

In order to determine the effect of the halogens on optical activity in the aliphatic series, a large number of halogen fatty esters have been prepared; but apart from the fact that the effect on rotation generally increases with the increasing mass or number of the halogen atoms, no satisfactory generalisation was arrived at.

123. **"The constitution of dehydro-β-naphthol sulphide and the interaction of sulphuric acid and aromatic o-hydroxysulphoxides."** **By Thomas Percy Hilditch and Samuel Smiles.**

The investigation of the action of sulphuric acid on the sulphoxides of *p*-cresol and *p*-chlorophenol has been continued. It is found that the primary products are isomeric with the original

sulphoxides, but contain the cyclic thioxin system. The formation of these substances is explained by assuming the production of a sulphonium-quinone from the *o*-hydroxy-sulphoxide in the same way that the sulphonium-quinones are formed from the *o*-sulphoxides of diphenylmethane and diphenylamine by the action of acids. This hypothesis is further confirmed by the behaviour of dehydro-β-naphthol sulphide, which has been formerly obtained by alkaline oxidation of β-naphthol sulphide. It was shown that this substance has the sulphonium-quinone structure,

$$O{:}C_{10}H_6{:}S{:}C_{10}H_6{:}O,$$

and that it very readily yields naphthathioxin when treated with alcoholic alkali hydroxide.

124. "**The action of steam on iron at high temperatures.**" **By John Albert Newton Friend, Thomas Ernest Hull, and Joseph Hallam Brown.**

The authors have studied the action of steam on iron at various temperatures up to and including 950°. At 500° the reaction was found to be too slow to admit of being carried to completion. The most favourable temperatures for study were found to lie between 650° and 820°. After five hours' heating at 820°, pieces of iron, 0·05 mm. in thickness, were completely converted into ferroso-ferric oxide. At lower temperatures equilibrium appeared to be obtained between the steam and mixtures of ferrous and ferroso-ferric oxide in varying proportions. The explanation that naturally suggests itself is that the outer layers of the metal have been converted into ferroso-ferric oxide, and the rate of diffusion is so slow at the temperatures under consideration that a practically infinite time is required for the oxidation of the interior portions. It was pointed out, however, that this is not the only explanation. It may be that definite mixtures of ferrous oxide and ferroso-ferric oxide are produced, having a lower dissociation pressure than ferroso-ferric oxide, but higher than ferrous oxide, the mixtures being in equilibrium with the steam at the various temperatures corresponding therewith.

125. "**Aromatic antimony compounds. Part II. The action of the chlorides of antimony on aniline and its derivatives.**" **By Percy May.**

The action of antimony trichloride on aniline has been referred to by Schiff (*Compt. rend.*, 1863, **56**, 1095) and by Leeds (*Amer. Chem. J.*, 1882, **3**, 137), but their observations are meagre and

contradictory, so that a more detailed investigation has now been made. Primary aryl derivatives of antimony, such as *p*-aminophenyldichlorostibine, $NH_2 \cdot C_6H_4 \cdot SbCl_2$, do not appear to be produced, but various additive compounds are formed. The following compounds have been isolated by the action of antimony trichloride on the corresponding amines under various conditions: *Trianiline antimony pentachloride*, $SbCl_5,3NH_2Ph$; *o-toluidine antimony trichloride*, $SbCl_3,C_7H_7 \cdot NH_2$; *p-toluidine antimony trichloride*, and *p-chloroaniline antimony trichloride*,

$$SbCl_3,C_6H_4Cl \cdot NH_2.$$

m- and *p*-Nitroanilines do not combine with antimony trichloride under the experimental conditions employed.

The above-mentioned compounds dissolve in hydrochloric acid, being thereby dissociated into their constituents. The solutions so obtained yield insoluble, crystalline diazo-compounds of the type $R \cdot N_2Cl,SbCl_3$ on treatment with nitrous acid.

Antimony pentachloride reacts violently with aniline, even when both substances are in dilute chloroform solution. It also reacts very vigorously with benzene, toluene, and xylene. In all these cases, partial chlorination of the aromatic compound takes place, the remainder then forming additive products with the antimony trichloride.

126. "Synthetical experiments in the group of the *iso*quinoline alkaloids. Part I. Anhydrocotarninephthalide." By Edward Hope and Robert Robinson.

An account was given of the preparation and properties of anhydrocotarninephthalide, and of a number of its derivatives.

127. "The solubility of electrolytes in aqueous solutions. Part I. Solubility of salts in the corresponding acids." By James Irvine Orme Masson.

Determinations have been made at 30° of the solubilities of sodium chloride and of barium chloride in aqueous hydrochloric acid, and of barium nitrate and of silver nitrate in aqueous nitric acid. The concentrations of acid were such that the solubilities of the salts ranged from 100 per cent. to about 3 per cent. of the values in pure water.

It has been found that the relation of acid concentration to solubility is well expressed by a simple linear differential equation of the first order. The formula also expresses satisfactorily Engel's results for the solubilities of numerous chlorides in hydrochloric

acid at 0° (*Compt. rend.*, 1886, **102**, 619; 1887, **104**, 433; *Ann. Chim. Phys.*, 1888, [vi], **13**, 132).

Study of the specific gravities shows that the molecular volumes of water, acid, and salt in saturated solution are to be regarded as constant in a given case; that is, they are independent of the proportions in which the constituents are mixed. By means of equations embodying this, the specific gravities of the solutions can be calculated with considerable accuracy.

128. "The effect of temperature and of pressure on the equilibrium $2CO \rightleftharpoons CO_2 + C$." By Thomas Fred Eric Rhead and Richard Vernon Wheeler.

In Le Chatelier's general formula for equilibrium in gaseous systems:

$$500 \int L \frac{dT}{T^2} + (N' - N) \log_e P + \log_e \frac{C_1^{n_1} . C'_1{}^{n'_1} . \ldots}{C_2^{n_2} . C'_2{}^{n'_2} \ldots} = k;$$

the effect of pressure, measured in atmospheres, is given by the expression $(N' - N) \log_e P$. Using a method of experiment at constant volume different from that previously employed by them (*Trans.*, 1910, **97**, 2182), the authors find that this formula holds for the system $2CO \rightleftharpoons CO_2 + C$ at all pressures between 0·5 and 3 atmospheres for temperatures between 1073° and 1373° Abs. The value of k, however, increases linearly from 19·85 to 20·15 over this range of temperature when the value of L (the total heat of the reaction) is regarded as constant and equal to 39,000 calories, as in their previous communication. The introduction of a value $L_T = L_0 + 2{\cdot}02T - 0{\cdot}0031 T^2$, calculated from the difference between the molecular heats at constant volume of the factors and products of the system, gives the constant a permanent value, 18·74, L_0 (the total heat of the reaction at absolute zero) being calculated as equal to 38,055 calories.

Le Chatelier's equation therefore becomes, for the system under consideration:

$$\tfrac{1}{2} . \frac{38{,}055 + 2{\cdot}02T - 0{\cdot}0031 T^2}{T} + \log_e P + \log_e \frac{C_{CO}{}^2}{C_{CO_2}} = 18{\cdot}74,$$

from which the percentage of carbon dioxide and carbon monoxide in equilibrium over excess of carbon can be calculated for any temperature and pressure.

The rate of attainment of equilibrium is extremely slow at temperatures below 1073° Abs.

129. **"Nitrites of the benzylammonium series: benzylammonium nitrite and dibenzylammonium nitrite, and their sublimation and decomposition by heat." By Prafulla Chandra Rây and Rasik Lal Datta.**

By the interaction of silver nitrite and mono- and di-benzylamine hydrochlorides respectively in aqueous solution, and evaporation in a vacuum of the filtrate, the corresponding nitrites are obtained. The nitrites of this series are more stable than the corresponding ones of the aliphatic series.

130. **"The conductivity and viscosity of aqueous solutions of aniline hydrochloride at 25°." By Nevil Vincent Sidgwick and Bernard Howell Wilsdon.**

These properties were measured for solutions from $N/10$ to more than $4N$. With increasing concentration the product of conductivity and viscosity first falls, reaching a minimum at about $2N$, and then remains nearly constant, with a slight tendency to rise. The product of the conductivity and the two-thirds power of the viscosity falls continuously.

131. **"The solubility of aniline in aqueous solutions of its hydrochloride." By Nevil Vincent Sidgwick, Percival Pickford, and Bernard Howell Wilsdon.**

Aniline is miscible in all proportions with water at 168°, and with $4{\cdot}5N$-hydrochloric acid at 30°. The authors have measured the solubility in solutions of various strengths, at temperatures up to complete miscibility. They have also determined at 25° the partition-coefficient (concentration in water/concentration in aniline) of the salt between the two layers. This falls rapidly with increasing concentration, being 20 for a $N/10$- (aqueous) solution, and 0·9 for a $1{\cdot}3N$-solution. The bearing of this on the shape of the solubility curves was discussed.

Some measurements have also been made of the conductivity and viscosity of solutions of the hydrochloride in mixtures of aniline and water. The results appear to indicate that the conductivity for a given concentration of salt is proportional to the amount of water in the solvent.

132. "Some reducing actions of mercury."
By David Borar.

The action of mercury on solutions of a number of substances has been examined with the following results:

(1) Potassium permanganate is reduced to potassium hydroxide and manganese dioxide, the mercury being oxidised to mercuric oxide.

(2) Potassium dichromate in neutral solution is not reduced. In the presence of hydrochloric acid, however, chromium chloride and mercurous chloride are formed.

(3) Ferric salts in the presence of hydrochloric acid are reduced to the ferrous state. The experiments showed that mercury may be used as reducing agent for ferric compounds in the estimation of iron.

(4) Potassium persulphate is reduced to potassium sulphate, the mercury being converted into a basic sulphate.

(5) Copper sulphate in the presence of hydrochloric acid is reduced to cuprous chloride.

(6) Nitrobenzene in the presence of hydrochloric acid is reduced to aniline to a small extent.

(7) Solutions of potassium nitrate, potassium chlorate, and sodium peroxide are not acted on by mercury to any appreciable extent.

133. "Note on the preparation of β-hydrindone."
By Jocelyn Field Thorpe.

In a previous paper (Moore and Thorpe, *Trans.*, 1908, **93**, 165) a process was described by which *o*-phenylenediacetonitrile, which is derived from *o*-xylylene dibromide by the action of potassium cyanide, could be quantitatively transformed into β-imino-α-cyanohydrindene by the action of sodium ethoxide, thus:

$$C_6H_4\begin{<}{CH_2Br}{CH_2Br}\longrightarrow C_6H_4\begin{<}{CH_2\cdot CN}{CH_2\cdot CN}\longrightarrow C_6H_4\begin{<}{-CH_2-}{CH(CN)}\!>\!C{:}NH.$$

It was also shown that β-imino-α-cyanohydrindene could be converted, through the corresponding carboxylic acid, into β-hydrindone:

$$C_6H_4\begin{<}{-CH_2-}{CH(CO_2H)}\!>\!C{:}NH\longrightarrow C_6H_4\begin{<}{CH_2}{CH_2}\!>\!CO.$$

Since that time it has been found that β-imino-α-cyanohydrindene can be directly converted into β-hydrindone by a much simpler process, and, as the yield by the newer method is 90 per cent. of the theoretical, the preparation of this ketone from *o*-xylene is now an easy matter.

Twenty grams of β-imino-α-cyanohydrindene are dissolved in 50 c.c. of cold concentrated sulphuric acid, and the clear solution is kept at the ordinary temperature for one hour. It is then poured into six times its volume of water, and distilled in a current of steam, a large flask being used for the purpose, as much frothing occurs. β-Hydrindone passes over with the steam, and solidifies in the receiver.

The *semicarbazone* of β-hydrindone, which does not appear to have been prepared previously, separates as a white precipitate when a solution of semicarbazide hydrochloride in aqueous sodium acetate is added to a solution of the ketone in dilute alcohol. It crystallises from hot absolute alcohol, in which it is only sparingly soluble, as slender needles, which melt and decompose at 218°:

0·1803 gave 0·4209 CO_2 and 0·0904 H_2O. C = 63·66; H = 5·57.

$C_{10}H_{11}ON_2$ requires C = 63·5; H = 5·8 per cent.

In the previous paper (*loc. cit.*, p. 174) it was stated that β-hydrindone prepared by this method does not alter on keeping, and it was suggested that the unstable character of this compound when prepared by other methods must be due to the presence of some impurity. This statement was written after the ketone had been under observation for three to four months prior to the publication of the paper. A specimen of β-hydrindone prepared by this method was found, however, to have been completely transformed into a brown, viscid resin after having been kept in a well-stoppered bottle for eighteen months.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 5th, 1911.

All persons who received grants in June, 1910, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Thursday, June 1st.

The Council wish to draw special attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

FARADAY LECTURE.

The Faraday Lecture will be delivered by Professor Theodore W. Richards, of Harvard University, on Wednesday, June 14th, 1911, at 8 p.m.

The Lecture will be given, by the kind permission of the Managers, in the theatre of the Royal Institution, 21, Albemarle Street, W.

Admission will be by ticket only. Full particulars will be announced in the next number of the "Proceedings."

At the next Ordinary Scientific Meeting on Thursday, May 18th, 1911, at 8.30 p.m., the following papers will be communicated:

"Some reactions of ω-bromomethylfurfuraldehyde." By W. F. Cooper and W. H. Nuttall.

"The course of chemical change in quinol under the action of radiant energy." By W. N. Hartley and O. H. Little.

"A method for the accurate volumetric determination of the oxygen in the air." By H. E. Watson.

"Electrolytic reduction. Part IV. Aromatic aldehydes." By H. D. Law.

"Mannitoboric acid." By J. J. Fox and A. J. H. Gauge.

"The Synthesis of ammonia by heat." By J. S. Cardell and F. Thomas.

R. CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.

[*Issued* 30/5/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. **No. 387.**

Thursday, May 18th, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. E. E. Walker, C. H. Hampshire, H. Christopher, H. F. Harwood, and Noel Deer were formally admitted Fellows of the Society.

THE PRESIDENT announced that a number of valuable chemical works of much historical interest had been presented to the Society by the family of the late Dr. W. J. Russell, F.R.S.; among them was a rare edition of Basil Valentine's *Triumphant Car of Antimony*, bearing an earlier date than the copy in the British Museum.

The Council, at its meeting that afternoon, had passed the following resolution:

"That the best thanks of the Council be accorded to the family of the late Dr. W. J. Russell, F.R.S., for their generous bequest of a number of chemical works of historical interest."

The PRESIDENT reminded the Fellows that Professor Theodore W. Richards would deliver the Faraday Lecture, entitled, "The Fundamental Properties of the Elements," in the theatre of the Royal Institution, on Wednesday, June 14th, 1911, at 8 p.m.

Certificates were read for the first time in favour of Messrs.:

Norman Ernest Atkinson, Ash Cottage, Thornhill Lees, Dewsbury.
Thomas Cowling, Easingwold, Yorks.
Rudolph Demuth, 68, Salusbury Road, N.W.
Cyril Herbert Koszelski Gonville, Milton, Queen's Road, Buckhurst Hill.
Henry Edmund Linenbröker, 100, Harrow Road, Paddington, W.
Leonard Ison Pitt, B.Sc., 109, Abbott Road, Bromley, E.

A Certificate has been authorised by the Council for presentation to ballot under Bye-law I. (3) in favour of Benjamin Gallsworthy, Thilawa, Burma.

INTERNATIONAL ASSOCIATION OF CHEMICAL SOCIETIES.

At a conference of delegates from the English, French, and German Chemical Societies, held in Paris on April 25th and 26th, it was decided to form an International Association of Chemical Societies. The delegates appointed by the three Societies were:

The Chemical Society, London: Professors Percy Frankland, Meldola, and Sir William Ramsay.

Société Chimique de France: Professors Béhal and Haller, and M. Hanriot.

Deutsche Chemische Gesellschaft: Professors Jacobson, Ostwald, and Wichelhaus.

The following Statutes of the Association, drafted by the delegates at the Paris conference, were approved by the Council of the Chemical Society at their meeting on May 18th.

Statutes.

Art. 1.—Il est fondé une Association internationale des Sociétés chimiques.

Art. 2.—Le but de l'Association est de former un lien entre les Sociétés chimiques du monde, pour s'occuper des questions ayant un intérêt général et international pour la Chimie.

Art. 3.—Toutes les Sociétés chimiques peuvent faire partie de l'Association.

Art. 4.—L'Association est dirigée par un Conseil formé d'un certain nombre de membres. Chaque pays ne peut être représenté dans le Conseil que par une seule Société chimique, qui désignera trois représentants.

Art. 5.—Le Conseil actuel comprend les délégués des Sociétés fondatrices, c'est-à-dire de la Société chimique allemande (Deutsche

chemische Gesellschaft), de la Société chimique anglaise (The Chemical Society, London) et de la Société chimique française (Société chimique de France).

La représentation d'une autre Société dans le Conseil ne pourra etre décidée que par celui-ci, et à la majorité des deux tiers des votants. Le vote par correspondance sera admis dans ce cas.

Art. 6.—Le Conseil fixe à chaque réunion le lieu et l'époque de la prochaine session.

Art. 7.—Le Conseil nomme au début de chaque session un Président, qui est en même temps Président de l'Association, et qui entrera en fonctions à la fin de la Session.

Art. 8.—Le Bureau est constitué par le Président, le Vice-Président et le Secrétaire Général qui sont les délégués du même pays.

Art. 9.—Le Président est chargé de convoquer le Bureau. Celui-ci veille à l'exécution des décisions prises par le Conseil: il fixe l'ordre du jour des Séances du Conseil et entretient des relations entre les diverses Sociétés. Le Président fait approuver les procès-verbaux des séances. Seul le procès-verbal de la dernière séance peut être approuvé par correspondance.

Art. 10.—Les moyens d'action de l'Association consistent:

En nomination de Commissions chargées d'étudier les questions qui leur seront soumises par le Conseil;

En publication dans les journaux des Sociétés affiliées ou en tout autre mode de publication qu'il conviendra au Conseil de choisir;

En Conférences et Congrès.

Art. 11.*—Les frais généraux seront supportés par les Sociétés affiliées au prorata du nombre de leurs membres.

Toutes les dépenses autres que les frais généraux ne seront imputables aux diverses Sociétés que sous réserve d'un engagement personnel de ces Sociétés.

Le Secrétaire Général soumettra à chaque session à l'approbation du Conseil le compte-rendu financier de l'exercice écoulé.

Art. 12.—Les modifications aux présents statuts ne pourront être votées qu'à la majorité des deux tiers des membres du Conseil. Le vote par correspondance est encore admis dans ce cas.

The Association proposes, in the first instance, to appoint international committees to consider and report on the following questions:

Nomenclature of Mineral Chemistry;

* L'article 11 ne deviendra définitif qu'après l'acceptation des trois Sociétés fondatrices.

Nomenclature of Organic Chemistry;
Unification of the modes of stating physical constants.

Professor Ostwald has been elected President of the Association for the ensuing year, and the next meeting has been fixed for April 13th, 1912, and is to take place in Berlin. The meeting in 1913 will be held in Great Britain.

Of the following papers, those marked * were read:

*134. "Some reactions of ω-bromomethylfurfuraldehyde."
By William Francis Cooper and Walter Harold Nuttall.

ω-*iso*Cyano- or ω-cyano-methylfurfuraldehyde cannot be prepared by the action of potassium or silver cyanide on ω-bromomethylfurfuraldehyde in alcoholic solution; owing to the great reactivity of the bromine atom in the ω-position, condensation of the furfuraldehyde with the alcohol takes place, with the production of ω-ethoxymethylfurfuraldehyde and the liberation of hydrogen bromide. The latter reacts with the silver cyanide, and hydrogen cyanide is evolved.

The same ethoxy-aldehyde may also be prepared by boiling an alcoholic solution of ω-bromomethylfurfuraldehyde with excess of calcium carbonate to neutralise the liberated hydrogen bromide.

ω-*Ethoxymethylfurfuraldehyde* is a yellow oil, readily soluble in the usual organic solvents; it dissolves in hot light petroleum, but is insoluble in the cold. It is also moderately soluble in water. When rapidly distilled, it boils at 235—240° without decomposition, but prolonged heating induces polymerisation. Under 35 mm. pressure it boils at 145°, and it has $D^{15\cdot5}_{15\cdot5}$ 1·1096. It shows all the usual properties of a furfuraldehyde.

The *phenylhydrazone* forms long, slender, yellow needles, melting at 55·5—56·2°, and the p-*bromophenylhydrazone* crystallises in shining, silky needles, melting at 104—105°.

ω-*Ethoxymethylpyromucic acid* is prepared by oxidising the above aldehyde with silver oxide. It is soluble in water, alcohol, ether, benzene, chloroform, or carbon disulphide, but insoluble in light petroleum, and forms long, colourless needles, melting at 57·5—58·5°.

ω-*Methoxymethylpyromucic acid* is obtained by oxidising ω-*methoxymethylfurfuraldehyde* prepared from ω-bromomethylfurfuraldehyde and methyl alcohol. It crystallises in long, silky needles, melting at 67·5—68·5°.

ω-Methoxymethylfurfuraldehyde, on oxidation with alkaline permanganate, gives dehydromucic acid. When ω-bromomethylfurfuraldehyde is boiled with water in the presence of barium carbonate,

it gives ω-hydroxymethylfurfuraldehyde; under certain conditions, however, a beautiful yellow, crystalline *compound*, $C_{11}H_{10}O_4$, is obtained, which melts at 111·5—112°. The compound may possibly be a condensation product of ω-bromomethylfurfuraldehyde and lævulic acid, the latter being formed by the decomposition of ω-hydroxymethylfurfuraldehyde:

$$C_6H_5O_2Br + C_5H_8O_3 = C_{11}H_{10}O_4 + HBr + H_2O.$$

Discussion.

Dr. Pyman pointed out that the conversion of ω-bromomethylfurfuraldehyde into ethoxymethylfurfuraldehyde by means of alcoholic potassium cyanide was analogous to the conversion of 4(or 5)-chloromethylglyoxaline into ethoxymethylglyoxaline under similar conditions (*Trans.*, 1911, **99**, 678). 4(or 5)-Chloromethylglyoxaline hydrochloride could, however, readily be converted into 4(or 5)-cyanomethylglyoxaline by adding its absolute alcoholic solution to ice-cold saturated aqueous potassium cyanide.

Mr. Cross suggested that the analogous reaction with alcoholic hydroxyl groups of cellulose might explain the limit of resolution of cellulose to ω-bromomethylfurfuraldehyde (Fenton).

Mr. Nuttall, in reply, said that the authors did not claim that the reaction of ω-bromomethylfurfuraldehyde with potassium or silver cyanide was unique, but merely unusual. A 30—40 per cent. yield of ω-bromomethylfurfuraldehyde could be obtained from cellulose by heating with hydrobromic acid in chloroform solution under pressure at 100°. In addition, a considerable quantity of insoluble "humus" was formed, and for some time the authors had been making an exhaustive examination of this product, and had obtained some interesting acids by oxidation.

***135. "A method for the accurate volumetric determination of the oxygen in air." By Herbert Edmeston Watson.**

An apparatus was described, in which about 50 c.c. of air are first measured at constant volume. The gas is then passed into a vessel containing phosphorus, which is warmed, and the residual gas finally reintroduced into the measuring vessel without removal from the apparatus. The accuracy of the method was discussed, and some preliminary results were given. These show that different analyses of the same sample usually agree to 2 parts in 10,000. A complete analysis can readily be performed in an hour and a-half.

Discussion.

Dr. Wade thought that the relative increase in accuracy above that obtainable with Haldane's well-known compensator burette was not commensurate with the comparatively large increase in complexity and in the time required. In his experience the percentage of oxygen in air could be determined by the compensator method with an accuracy of $\pm$ 1 part per 1000.

Mr. Watson, in reply to the President, said that Regnault's method of air analysis was objectionable because it involved the use of moist gases, and for accurate work a compressibility correction had to be applied. Ammonia was also formed by the explosion of air and hydrogen, thereby vitiating the absolute results. Regnault's absolute values were slightly lower than those found with the present apparatus, which agreed with those of Leduc.

*136. "Mannitoboric acid."

By John Jacob Fox and Arthur Josiah Hoffmeister Gauge.

Mannitoboric acid, $C_6H_{15}O_8B$, is prepared from mixtures of mannitol and boric acid dissolved in absolute alcohol. It separates from the alcoholic solutions in tufts of prisms, melting at 89·5°. The acid dissolves readily in water or hot alcohol, but is decomposed by these solvents. Mannitoboric acid behaves as a monobasic acid, and yields normal *ammonium*, *silver*, *calcium*, and *barium* salts. The salts are crystalline powders, soluble in water, and precipitated from aqueous solutions by alcohol.

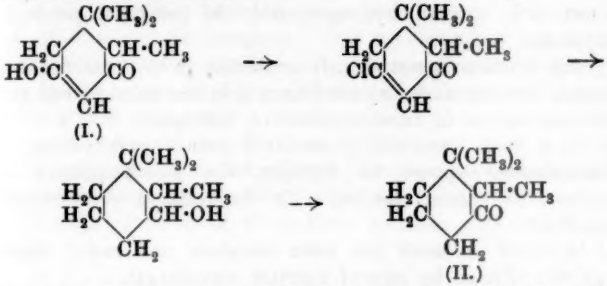
Measurements of the rotations of mixtures of mannitol and boric acid were made, both in alcohol and in water. The results indicate that the formation of mannitoboric acid is favoured by increasing the concentration of either the mannitol or the boric acid.

Discussion.

Dr. Fox, in reply to the President, stated that the curves for the rotation of mixtures of mannitol and boric acid in alcoholic solutions appeared to reach a maximum: the fact that it was impossible to dissolve larger quantities of boric acid than those used had prevented the authors from following the curves to their completion. In one or two cases, however, a maximum value had been obtained.

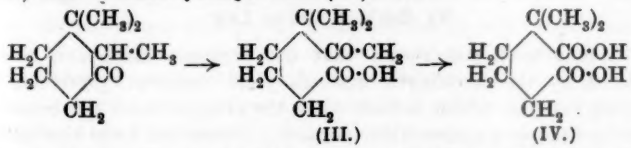
***137. "Hydroaromatic ketones. Part II. 1 : 1 : 2-Trimethyl*cyclo*hexan-3-one." By Arthur William Crossley and Nora Renouf.**

1 : 1 : 2-*Trimethyl*cyclo*hexan*-3-*one* (II) has been prepared from 1 : 1 : 2-trimethyldihydroresorcin (I) by a series of reactions indicated by the following formulæ:



(I.) (II.)

The proof of the constitution of the ketone is afforded by a study of its oxidation products, which are δ-acetyl-δ-methylhexoic acid (III) and *αα*-dimethyladipic acid (IV):



(III.) (IV.)

The preparation of the ketone was originally undertaken with the idea of comparing its properties and transformations with those of camphor, since these two substances show a marked resemblance in the arrangement of the various groupings in their molecules. During the course of the work it became evident that a closer investigation of the properties of trimethyldihydroresorcin and its derivatives was highly desirable, because the molecule is not symmetrical, as in the case of dimethyldihydroresorcin, and the work described shows that many complicated questions of isomerism are involved which are at present being more fully studied.

138. "The course of chemical change in quinol under the influence of radiant energy." By Walter Noel Hartley and Otway Henry Little.

For the purpose of examining the extent to which radiant energy operates on certain organic substances so as to cause a change in constitution and in chemical properties, more than thirty-six

experiments were made at different temperatures, on quinol in a state of vapour, in darkness, diffused daylight, and in ultra-violet rays, flasks of glass and of quartz being used. The course of chemical change was measured by the volume of hydrogen evolved.

(1) The reaction $C_6H_4(OH)_2 \rightleftharpoons C_6H_4O_2 + H_2$ seems to attain a condition of equilibrium when 0·6 of a milligram-molecule of quinol has lost 6·7 c.c. of hydrogen, and the principal product is quinhydrone.

(2) The reaction is not strictly reversible in the presence of air or oxygen, because under no conditions does the quinhydrone revert to quinone, except in an atmosphere of hydrogen.

(3) In a flask containing crystallised quinol, quinhydrone, and *p*-benzoquinone, exposed to daylight, the *p*-benzoquinone soon disappears, its vapour reacting with the residual quinol to form quinhydrone.

(4) In every instance the most complete and rapid chemical change was effected by rays of shortest wave-length.

139. "Electrolytic reduction. Part IV. Aromatic aldehydes." By Herbert Drake Law.

Previous work has shown that the aromatic aldehydes, when reduced by the electrolytic method, yield resinous products in varying amount, which is least when the groups round the benzene nucleus occupy a symmetrical position. Deviations from the latter configuration influence the course of the reduction in such a manner that the resin production becomes most prominent when the change in the structure is greatest. This view has now been confirmed in the case of the three monochlorobenzaldehydes. Experiments have also been conducted in a nearly neutral medium, and this change is accompanied by a great decrease in the resin formation.

140. "Synthesis of ammonia by heat." By Ivor Southwell Cardell and Fred Thomas.

The authors find that ammonia cannot be produced from pure hydrogen and nitrogen, but combination takes place in the presence of oxides of nitrogen.

With nitric oxide the amount of ammonia formed decreases with the increased rate of passage of the gases through the experimental tube, but the reverse holds good in the case of nitrous oxide. This is explained by the relative stability of the two oxides.

141. **"A method of chlorination: chlorination of anilines and phenols." By Kennedy Joseph Previté Orton and Harold King.**

The method of chlorination, which was described, is based on the reversible interaction between chloroamine and hydrochloric acid, studied by Orton and Jones (*Trans.*, 1909, **95**, 1456). By proper choice of the quantities of hydrochloric acid, any given concentration of chlorine can be obtained. This concentration will remain constant during the chlorination, since a molecule of chlorine used in substitution is replaced by a molecule of hydrogen chloride, which in its turn reacts with a further amount of chloroamine:

$$Ar{\cdot}NCl{\cdot}Ac + HCl = Ar{\cdot}NH{\cdot}Ac + Cl_2.$$

In this way, oxidation and other side reactions can be avoided, and the operation most effectively controlled.

A few chloro-derivatives of anilines, hitherto unrecorded, were described.

142. **"The intermolecular condensation of aromatic sulphinic acids. Part II. The interaction of aromatic disulphoxides and sulphuric acid." By Thomas Percy Hilditch**

The decomposition of aromatic disulphoxides by cold concentrated sulphuric acid was shown to be dependent chiefly on the number and position of the alkyl substituents in the aromatic nucleus. In all cases, however, the primary reaction can only be explained by supposing that the disulphoxide molecule undergoes hydrolytic fission with formation of a mixture of sulphinic and (unstable) sulphoxylic acids:

$$R{\cdot}SO{\cdot}SO{\cdot}R \overset{H_2O}{\rightleftharpoons} R{\cdot}SO_2H + R{\cdot}S{\cdot}OH.$$

These intermediate products may then in certain cases unite to more complex derivatives, such as oxides of the diphenylene disulphides, or, in presence of a phenolic ether, may suffer condensation to simple or complex sulphonium bases, according to the nature of the substitution in the aromatic residue.

The compounds investigated were diphenyl-, di-*p*-phenetyl-, and di-*p*-tolyl methyl ether disulphoxide, both in presence of, and without the addition of, a phenolic ether (phenetole or *p*-tolyl methyl ether).

143. **"The action of sodium hypophosphite on copper sulphate in aqueous solution." By James Brierley Firth and James Eckersley Myers.**

The authors have examined the above reaction in acid solution, and find that the composition of the product depends on the condi-

tions under which the reaction is carried out. The reaction proceeds through a series of stages, and finally yields a black substance containing hydride, oxide, and phosphate of copper.

This substance, when quite dry, is unstable, and frequently decomposes spontaneously on exposure to air, with the production of water, hydrogen, copper, copper oxide, and copper phosphate.

144. "Note on some metallic compounds of substituted ammonias." By William Robert Lang.

In continuation of his work on the metallic compounds of substituted ammonias (Lang and Rigaut, *Trans.*, 1899, **75**, 883; Lang, *ibid.*, 1903, **83**, 724; Lang and Carson, *Proc.*, 1903, **19**, 147; Lang and Jolliffe, *ibid.*; Lang and Carson, *J. Amer. Chem. Soc.*, 1904, **26**, 758; compare also Girardet, *Bull. Soc. chim.*, 1910, [iv], **7**, 1028), the author has prepared a compound from cuprous thiocyanate and trimethylamine.

Cuprous thiocyanate was carefully prepared, and subjected to the action of an excess of dry trimethylamine, the reaction vessel—similar to that employed in former experiments—being cooled by solid carbon dioxide. After remaining in contact with the copper salt for several days, the excess of methylamine was removed, and the resulting compound examined. A second and third application of trimethylamine, with subsequent drying and weighing, yielded the same result, namely, a compound corresponding with the formula $CuSCN,N(CH_3)_3$.

145. "The decomposition of diethylenesulphidemethylsulphine hydroxide in aqueous solution." By Leila Green and Brenda Sutherland.

The hydroxide corresponding with the salts of diethylenesulphidemethylsulphine decomposes spontaneously into water and a neutral oil (Masson, *Trans.*, 1886, **49**, 233; Mansfeld, *Ber.*, 1886, **19**, 696, 2658; V. Meyer, *ibid.*, 3262). The authors have measured the velocity of this action at 55° in solutions sufficiently dilute to justify the simplifying assumption of total ionisation, using solutions of the pure hydroxide, and also others containing excess of hydroxyl (added sodium hydroxide), or of the sulphine cation (added $C_5H_{11}S_2I$). The results show that the action is of the second order, and that the velocity is directly proportional to the concentration of each of the ions of the sulphine base; or it may be represented by the equation:

$$C_5H_{11}S_2^{\cdot} + OH' = C_5H_{10}S_2 + H_2O.$$

146. "Properties of binary mixtures of some liquefied gases." By Lancelot Salisbury Bagster.

In a previous paper (*Trans.*, 1910, **97**, 2607) an account was given by the author, in conjunction with Dr. B. D. Steele, of the vapour-pressure curves of binary mixtures of hydrogen sulphide with hydrogen bromide and hydrogen iodide. Hydrogen bromide gave a curve with a minimum, hydrogen iodide a straight line. The freezing-point curves of the above mixtures have been determined in order to ascertain whether there was a corresponding difference. Both curves are of the same type. They are continuous, showing a minimum, but no eutectic point, being of the form produced by a system in which the solid phase consists of mixed crystals. Thus the difference indicated by the vapour-pressure curves is not borne out by the freezing points.

147. "Note on the monosodium salt of 1-nitroso-2-naphthol-3:6-disulphonic acid." By Percy May.

The aqueous solution of the monosodium salt of 1-nitroso-2-naphthol-3:6-disulphonic acid, $NO\cdot C_{10}H_4(OH)(SO_3H)\cdot SO_3Na,\frac{1}{2}H_2O$, is orange-red, becoming pink on dilution. Solutions of the neutral salts are dark green, turning to yellowish-green on dilution.

148. "Synthesis of pinacones. Part I." By William Parry.

By the action of the appropriate Grignard reagent on ethyl α-hydroxy*iso*butyrate (*Proc.*, 1909, **25**, 305), the following pinacones have been prepared:

(1) Pinacone, which was isolated in the form of its hydrate, $OH\cdot CMe_2\cdot CMe_2\cdot OH,6H_2O$, melting at 44—46°.

(2) *β-Methyl-γ-ethylpentane-βγ-diol*, $OH\cdot CMe_2\cdot CEt_2\cdot OH$; a colourless, viscid oil, boiling at 100°/20 mm., soluble in boiling water. Repeated fractionation under atmospheric pressure results in the elimination of the elements of water with the production of *diethylisopropenylcarbinol*, $CH_2{:}CMe\cdot CEt_2\cdot OH$, which has an odour of camphor, and boils at 150—152°/767 mm.

(3) *β-Methyl-γ-propylhexane-βγ-diol*, $OH\cdot CMe_2\cdot CPr^n_2\cdot OH$; a colourless, viscid oil, boiling at 105°/15 mm. It cannot be distilled under the ordinary pressure without losing the elements of water.

(4) *αα-Diphenyl-β-methylpropane-αβ-diol*, $OH\cdot CMe_2\cdot CPh_2\cdot OH$; white, silky needles, melting at 89—89·5°, and readily soluble in the

common organic media, with the exception of light petroleum. Acetic anhydride containing one or two drops of sulphuric acid dehydrates it, with the formation, probably, of *as-diphenyldimethyl ethylene oxide*, $\begin{matrix}CMe_2\\|\\CPh_2\end{matrix}\!\!>\!O$, colourless prisms, melting at 44—45°.

(5) *αα-Dibenzyl-β-methylpropane-αβ-diol*,

$$OH\cdot CMe_2\cdot C(CH_2Ph)_2\cdot OH;$$

colourless prisms, melting at 47—48°. At the same time a small quantity of an unsaturated alcohol is formed, which distils at 165—168°/12 mm., and is probably *dibenzylisopropenylcarbinol*, $CH_2{:}CMe\cdot C(CH_2Ph)_2\cdot OH$.

(6) *αα-Dinaphthyl-β-methylpropane-αβ-diol*,

$$OH\cdot CMe_2\cdot C(C_{10}H_7)_2\cdot OH;$$

small, white crystals, melting at 166—166·5°.

The solid pinacones have normal molecular weight in dilute benzene solution.

Experiments are now being conducted with ethyl α-ethyl-α-hydroxybutyrate, which appears to react in a different manner with the magnesium alkyl haloids.

149. "A method for the accurate estimation of traces of water in ether." By Dan Tyrer.

It is occasionally of importance to determine with accuracy the amount of water contained in a sample of "wet" ether. A method susceptible of a great degree of accuracy can be based on the fact that the addition of a little water to ether greatly increases its solvent power for some solutes. The most suitable substance which can be used as a solute is cadmium iodide. According to Eder (*Dingl. Polytech. J.*, 1876, **221**, 189), cadmium iodide is soluble in "absolute" ether to the extent of 28 per cent. Using a very dry sample of ether, it was found by the author, however, that cadmium iodide is practically insoluble in ether. It is to be presumed that the high value obtained by Eder was due to the ether he used containing water and alcohol. In the following table is given the solubility of cadmium iodide at 12° in pure ether and in ether containing various quantities of water. The ether used was Kahlbaum's pure material, prepared from ethyl alcohol, and thoroughly dried by twice distilling over phosphoric oxide.

Grams of water in 100 of ether.	Grams of CdI_2 per 100 of solvent.	Grams of water in 100 of ether.	Grams of CdI_2 per 100 of solvent.
0·0	0·143	0·90	6·46
0·10	0·78	1·00	7·30
0·30	2·07	1·10	8·27
0·50	3·36	1·14 (saturated)	8·68
0·70	4·77		

The above results were read from a smoothed curve of experimental values. On inspecting the table it will be seen that an addition of 0·1 per cent. of water to dry ether increases the solubility of the cadmium iodide by about 0·64 unit. Now as the solubility can be determined with ease to within an error less than 0·01 unit, the percentage amount of water in the ether can be found to less than 0·001 unit.

This method of analysis might be extended to the determination of traces of water in the alcohols, it being only necessary to find a suitable solute and to obtain a perfectly anhydrous alcohol.

150. "Equilibrium in the system: ethyl alcohol, acetic acid, ethyl acetate and water, and its apparent displacement by hydrogen chloride." By William Jacob Jones and Arthur Lapworth.

The authors find that the equilibrium constant in this liquid system appears to rise from the usually accepted value 4, to at least 8, when hydrogen chloride is present in considerable quantities. No ethyl chloride was formed during the experiments, the whole of the hydrogen chloride being recovered.

The observations are easily accounted for on the assumption that the hydrogen chloride unites with part of the water, and the numbers obtained at 25° suggest that one molecule of hydrogen chloride removes two molecules of water from the sphere of action.

151. "The heat of hydrolysis of ethyl alcohol hydrochloride. A correction." By William Jacob Jones and Arthur Lapworth.

An arithmetical blunder led the authors to record the heat associated with the reaction:

$$C_2H_6O,HCl + H_2O = C_2H_6O + H_2O,HCl,$$

or, more strictly:

$$C_2H_6O,H^{\cdot} + H_2O = C_2H_6O + H_2O,H^{\cdot},$$

in alcoholic solution, as, roughly, 1100 gram-calories. The true value is much greater than this, probably about 4300 gram-calories (compare this vol., p. 101).

152. "Derivatives of silicoethane and silicoethylene." By Frederic Stanley Kipping.

For some time past the author has been making experiments on the linking together of silicon atoms, and in the course of this

work he has studied the action of sodium on various aryl and alkyl-aryl-substitution products of silicon tetrachloride. The investigation is still incomplete, but a preliminary note on the subject seems to be desirable in view of Schlenk, Renning, and Racky's paper on hexaphenylsilicoethane, which has just been published (*Ber.*, 1911, **44**, 1178).

Hexaphenylsilicoethane, $SiPh_3 \cdot SiPh_3$, was prepared from triphenylsilicyl chloride by the author more than a year ago; it crystallises well from tetrachloroethane, and melts at about 360°.

The compounds obtained from the disubstitution products of silicon tetrachloride have properties very different from those of this saturated substance; from phenylethylsilicon dichloride, for example, a compound having the composition of *diphenyldiethylsilicoethylene*, SiPhEt:SiPhEt, is easily produced, but it is a vitreous and easily fusible solid, readily soluble in most of the common solvents, except the alcohols.

ADDITIONS TO THE LIBRARY.

Presented by the Family of the late Dr. W. J. Russell, F.R.S.

Accum, *Fredrick*. Description of the process of manufacturing coal gas, . . . with elevations, sections and plans. pp. xvi + 334. ill. London 1819.

Barlow, [*Peter*]. Barlow's Tables of squares, cubes, square roots, cube roots, reciprocals of all integer numbers up to 10,000. Stereotype edition, examined and corrected. pp. viii + 200. London 1840.

Berzelius, *Jöns Jacob*. Essai sur la théorie des proportions chimiques et sur l'influence chimique de l'électricité. Traduit du Suédois. pp. xvi + 190 + [ii] + 120 + [ii]. Paris 1819.

Birch, *Thomas*. The life of the Honourable Robert Boyle. pp. [iv] + 458 + [xvi]. London 1744.

Boyle, *Robert*. Philosophical works, Abridged . . . by *Peter* **Shaw**. 2nd edition, corrected. 3 vols. pp. [iv] + xliii + 730, xx + 726, [iv] + xv + iv + 756. ill. London 1738.

—— See **Birch**, *Thomas*.

Davy, *Sir Humphry*. See **Paris**, *John Ayrton*.

Kopp, *Hermann*. Die Entwickelung der Chemie in der neuren Zeit. pp. xxii + 854. München 1873.

Lavoisier, *Antoine Laurent*. Traité élémentaire de chimie, présenté dans un ordre nouveau et d'après les découvertes modernes. 2nd edition. pp. xliv + 322, viii + 327. Paris 1793.

Paris, ***John Ayrton.*** **The life of Sir Humphry Davy. 2 vols. pp. xvi + 416, viii + 463. London 1831.**

Pellatt, ***Apsley.*** **Curiosities of glass-making. With details of the processes and productions of ancient and modern ornamental glass manufacture. pp. vi + 146. ill. London 1849.**

Valentine, ***Basil.*** **The triumphant chariot of antimony, being a conscientious discovery of the many reall transcendent excellencies included in that minerall. Faithfully Englished and published for the common good by J. H. Oxon. Printed for Thomas Bruster, and are to be sold at the three Bibles neere the West end of Paules Church-Yard in London, 1660.**

A rare first edition not mentioned in the bibliographies and differing from the 1661 edition in date and publisher.

THE FARADAY LECTURE.

The Faraday Lecture, entitled, "The Fundamental Properties of the Elements," will be delivered by Professor Theodore W. Richards, of Harvard University, on Wednesday, June 14th, 1911, at 8 p.m.

The Lecture will be given, by the kind permission of the Managers, in the theatre of the Royal Institution, 21, Albemarle Street, W.

Admission will be by ticket only. Each Fellow of the Society is entitled to two tickets, which may be obtained on application to the Assistant Secretary, Chemical Society, Burlington House, W.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 5th, 1911.

All persons who received grants in June, 1910, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Thursday, June 1st.

The Council wish to draw special attention to the fact that the

income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less specially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

At the next Ordinary Scientific Meeting on **Thursday, June 1st, 1911, at 8.30** p.m., the following papers will be communicated:

"The dissociation pressures of the alkali bicarbonates. Part I. Sodium hydrogen carbonate." By R. M. Caven and H. J. S. Sand.

"The absorption spectra of cinchonine, quinine, and their isomerides." By J. J. Dobbie and A. Lauder.

"The influence of conjugated linkings on general absorptive power. Part II. Some open-chain and cyclic compounds." By C. R. Crymble, A. W. Stewart, R. Wright, and Miss F. W. Rea.

"The constituents of the bulb of *Buphane Disticha*." By F. Tutin.

"New derivatives of aminolauronic acid." By J. Weir.

"The triazo-group. Part XVIII. β-Triazoethylamine." By M. O. Forster and S. H. Newman.

"The interaction of formic acid and cellulose." By C. F. Cross and E. J. Bevan.

"Configuration of the stereoisomeric dibromosuccinic acids." (Preliminary note.) By A. McKenzie.

R. CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.

[*Issued* 13/6/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 388.

Thursday, June 1st, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. Ralph Roscoe Enfield, Victor John Harding, and Arthur A. Eldridge were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Percy James Raymond, 20, Arboretum Road, Worcester.
Ernest Vanstone, B.Sc., Gwynfe House, Mount Pleasant, Neath.

Of the following papers, those marked * were read:

***153. "The dissociation pressures of the alkali bicarbonates. Part I. Sodium hydrogen carbonate." By Robert Martin Caven and Henry Julius Salomon Sand.**

The dissociation pressures of sodium carbonate monohydrate and of sodium hydrogen carbonate have been examined by means of a specially designed tensimeter.

Difficulty was experienced in the latter case, particularly from the formation of impermeable crusts on the bicarbonate. Satisfactory results were obtained only when the amount of bicarbonate employed was four or five hundred times that theoretically required

to evolve the necessary volume of gas at the highest temperature reached in the experiments.

It was found that the vapour pressure, in mm. of mercury, of sodium carbonate monohydrate can be represented with sufficient accuracy by the equation: $\log p = 10{\cdot}825 - \frac{3000}{T}$, and that of sodium hydrogen carbonate by the equation: $\log p = 11{\cdot}8185 - \frac{3340}{T}$.

From these equations the heat of dissociation of one gram-molecule of sodium carbonate monohydrate is calculated to be 13,800 calories, and that of two gram-molecules of sodium hydrogen carbonate to be 30,700 calories. The latter figure is in sufficient agreement with the number 29,700 calculated from thermochemical results given by de Forcrand (*Compt. rend.*, 1909, **149**, 719).

The pressures corresponding with the four-phase equilibrium—anhydrous sodium carbonate, sodium carbonate monohydrate, sodium hydrogen carbonate, vapour—have also been calculated.

***154. "The absorption spectra of cinchonine, quinine, and their isomerides." By James Johnston Dobbie and Alexander Lauder.**

The authors have examined the absorption spectra of cinchonine, quinine, and their isomerides, and find that each alkaloid gives two distinct spectra, *A* and *B*, the band in *B* being more sharply defined and much more persistent than the band in *A*. The spectrum *A* is obtained when the alkaloid is dissolved in alcohol or in water containing not more than one equivalent of acid to one of the base; the spectrum *B* when it is dissolved in water containing at least two equivalents of acid to one of the base.

The difference between the two spectra was shown to be associated with the fact that the nitrogen of the quinoline nucleus is tervalent in the former, but quinquevalent in the latter case.

It was further shown that the spectrum *A* of cinchonine is practically identical with the spectrum of quinoline in alcohol, and the spectrum *B* with the spectrum of quinoline salts in aqueous solution. This is explained by the circumstance that the whole of the molecule of the alkaloid, except the quinoline nucleus, is, according to the generally accepted view of the constitution of the alkaloid, completely reduced, and reduced rings, as is well known, cause no selective absorption.

The absorption spectra of the isomerides examined are indistinguishable from those of cinchonine and quinine respectively.

*155. "The constituents of the bulb of Buphane disticha." By Frank Tutin.

Buphane disticha, Herb., is a bulbous plant, indigenous to South Africa, and has long been known to possess toxic properties.

The living, inner portions of the bulb contain an abundant amount of alkaloid, whilst the dry, outer layers are free from such a substance.

An alcoholic extract of the inner portions of the bulb, when distilled with steam, yielded a small amount of an essential oil containing furfuraldehyde.

The portion of the non-volatile product which was soluble in water yielded a small amount of acetovanillone (4-hydroxy-3-methoxyacetophenone), a quantity of chelidonic acid, and considerable amounts of copper and lævulose. It also gave a mixture of alkaloids, the principal constituent of which is an amorphous, strongly basic product, designated *buphanine*, which possesses a physiological action similar to that of hyoscine. A weakly basic alkaloid, and one soluble in water, together with small amounts of narcissine, $C_{16}H_{17}O_4N$, were also obtained. The weakly-basic alkaloid is a convulsant poison, whilst the base soluble in water resembles colchicine and narcissine in its action.

Buphanine, on hydrolysis, is converted into a crystalline alkaloid, *buphanitine*, $C_{23}H_{24}O_6N_2$, which melts at 240°. *Buphanitine hydrochloride* and *methiodide* were also prepared.

The portion of the original extract which was insoluble in water consisted of amorphous products, together with pentatriacontane, a phytosterol, ipuranol, $C_{23}H_{38}O_2(OH)_2$, and a mixture of fatty acids, both free and combined.

*156. "The interaction of formic acid and cellulose." By Charles Frederick Cross and Edward John Bevan.

Derivatives of cellulose obtained by direct interaction with formic acid, and also in presence of catalysts, have been investigated, and the quantitative data as to composition and decomposition (saponification both by alkalis and acids) are not reconcilable with the view that the products are simple esters of a normal cellulose.

Other modes of action of formic acid are known, and may explain the observed anomalies.

The interaction of cellulose and simple hydroxy-compounds was described, particularly in the case of resorcinol, which yields a well crystallised product, the alkaline solutions of which are crimson.

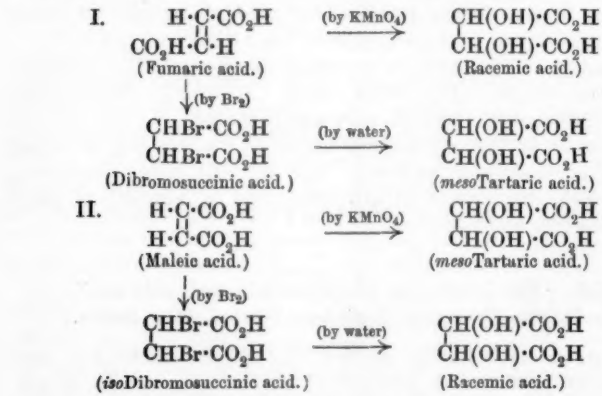
The quantitative data accord with a C_{13} formula.

This evidence, on the one hand, and the well known changes of the hexoses under the action of condensing acids on the other, were considered in relation to the interaction of formic acid and cellulose, in which more than one of the possible functions of the acid are involved.

***157. "Configuration of the stereoisomeric dibromosuccinic acids." (Preliminary note.) By Alex. McKenzie.**

Dibromosuccinic acid is formed by the action of bromine on fumaric acid, whilst maleic acid gives *iso*dibromosuccinic acid, Although a large amount of research has been devoted to these dibromo-acids, the question of their configuration had not been settled. Obviously, one of them must be resolvable into optically active components, and the other must be of the *meso*-type. The author finds that the *iso*-acid is the resolvable form.

The author was led to examine this problem by a consideration of the Walden inversion, on the one hand, and of the following changes, which are recorded in the literature, on the other:



In the displacement of the halogen by the hydroxy-groups in these cases, it was conceivable that one had to deal with a change of configuration, or, in other words, with a process which was equivalent to a Walden inversion with optically inactive material. The other alternative was that the direct hydroxylation of fumaric and maleic acids with permanganate followed a stereochemical course of a different order from that followed by the direct addition of bromine. The experiments of the author are in favour of the latter view. Further, since the oxidation of fumaric and maleic

acids by permanganate does not apparently lead to the formation of a mixture of *r*- and *meso*-tartaric acids, it appears likely that a change of configuration takes place during the addition of bromine.

*iso*Dibromosuccinic acid was prepared by the action of bromine on maleic acid in the presence of ether. The experimental conditions may be regulated so that practically no fumaric acid is produced, and the course of action depends to a remarkable degree on the quality of the ether used. The oxonium complex, $C_2H_5>O<Br$ $C_2H_5 \quad Br$, described by Tschelinzeff, is possibly produced as an intermediate phase.

The ease with which the bromine in the *iso*-acid is displaced renders the resolution a difficult one. A partial resolution was, however, effected by means of morphine, using methyl alcohol as solvent.

Morphine (21 grams, 1 mol.) was dissolved in warm methyl alcohol (290 c.c.), and, when the temperature of the solution was 46°, 19 grams (1 mol.) of the *iso*-acid were added in one instalment. The solution of the acid was immediately followed by the separation of glassy crystals of a morphine salt. After twenty-four hours at about 15°, the crystals (22 grams) were removed. So far, it has not been found practical to crystallise further the salt which separates under these conditions. The resulting acid was strongly lævorotatory, giving $[\alpha]_D$ −100·7° for $c=8{\cdot}6$ in ethyl acetate solution. The mother liquor, from which the morphine salt had been removed, gave a dextrorotatory acid. 6·5 Grams of the acid with $[\alpha]_D$ −100·7° were then treated with a solution of 7·1 grams of morphine in 100 c.c. of methyl alcohol. The resulting crystals (9·5 grams) gave an acid with $[\alpha]_D$ −114·5° for $c=7{\cdot}4$ in ethyl acetate solution. The latter acid (2·5 grams) was again acted on by a solution of 2·8 grams of morphine in 80 c.c. of methyl alcohol. The yield of salt was 3·5 grams, and the acid from this gave the value $[\alpha]_D$ −118° for $c=8{\cdot}47$ in ethyl acetate solution. So far, there is no evidence to show that this acid is the pure *l*-isomeride, and the work is being continued with the view of obtaining the latter.

Discussion.

The President pointed out that the great interest attaching to Dr. McKenzie's investigation was that he had definitely fixed the Walden inversion as taking place in the passage from fumaric to dibromosuccinic acid and in that from maleic to *iso*dibromosuccinic acid respectively. In previously investigated Walden changes it was always uncertain whether the inversion took place in the introduction of the halogen or in its removal. Although in the

present case the inversion took place in inactive material, it appeared to him that it was actually brought about by the presence of asymmetric groupings within the molecules concerned. Thus if, according to accepted views, the double linking in fumaric acid were opened up, for example, by the addition of two atoms of bromine, the normal result must be the formation of a *racemic* compound, and if instead a *meso*-compound were produced it must depend on an atom of bromine and an atom of hydrogen exchanging places in one of the two halves of the molecule. Such an interchange could, according to accepted views on asymmetry, only be effected under the directing influence of asymmetric matter itself, as towards symmetric matter the two alternative groupings were in every respect equivalent. Such asymmetric directive influence appeared to him to be available in the present instance as soon as one atom of bromine had become attached, for the resulting asymmetric grouping $HO_2C—\underset{Br}{\overset{|}{C}}—H$ would influence the configuration of the asymmetric grouping built up in the other half of the molecule, when the second atom of bromine became attached, with the result, as appeared from the author's experiments, that instead of the grouping: $H—\underset{CO_2H}{\overset{Br}{C}}$, there was obtained $Br—\underset{CO_2H}{\overset{H}{C}}$.

The same reasoning applied to the formation of the racemic *iso*dibromosuccinic acid from maleic acid.

One was naturally led to inquire as to what asymmetric agency directed the transformation of one enantiomorph into the other in the case of the ordinary Walden inversions, and he wished to suggest that an asymmetric grouping which might exert such a directive influence was to be found in the probable combinations (by association or otherwise) of molecules of the optically active compound undergoing the halogenation of hydroxy- or amino-groups or the hydrolysis or amidation of halogen groups (these being the reactions in which the inversion had been found to take place). This hypothesis was in accord with the observations of Emil Fischer that optically active acids and their esters or their glycines often behaved differently, and again that different bases had different effects in respect of inversive action when used for the hydrolysis of optically active halogen compounds. Such different bases might be expected to alter profoundly the condition of association or of other state of combination in which the halogen compounds might exist, besides altering the nature of the asymmetric grouping which was influencing the asymmetric group actually undergoing hydrolysis.

This hypothesis also indicated the possibility of a single enantiomorph (or the preponderance of one enantiomorph) emerging from a reaction in which an asymmetric grouping was, during a reaction, temporarily transformed into an unsaturated one.

Dr. SENTER, with reference to the President's suggestion that the intermediate formation of bimolecular compounds might play a part in the Walden inversion, said that he had recently obtained evidence of the formation of such a compound, namely,

$$CH_2Br{\cdot}CO_2{\cdot}CH_2{\cdot}CO_2Na,$$

in the hydrolytic decomposition of sodium bromoacetate. The final product, glycollic acid, was formed both by the hydrolysis of this compound and by the direct hydrolytic decomposition of sodium bromoacetate, in proportions depending on the dilution and temperature. As regards the further explanation of the formation of active compounds based on the assumption of the successive addition of bromine atoms at a double bond, it would be interesting to know if there was any direct evidence of such a mode of addition. The available evidence appeared to show that free oxygen, and also hydrogen, always combined as whole molecules, with subsequent rearrangement, but other elements, including the halogens, might behave differently in this respect.

158. "The influence of conjugated linkings on general absorptive power. Part II. Some open-chain and cyclic compounds." By Cecil Reginald Crymble, Alfred Walter Stewart, Robert Wright, and Florence Williamson Rea.

In continuation of the previous work on this subject, an examination has been made of the absorption spectra of isomeric substances containing double bonds in different positions in the molecule. Eighteen spectra have been compared in the case of isomeric substances, and it has been found that in every case the conjugation of double linkings increases the general absorptive power of the compound. This influence is specially marked in the case of two other substances, namely, crotonic acid and allylacetic acid; for here, although the former compound contains fewer atoms and has the same number of double bonds, yet its absorptive power is very much more marked than that of the latter, in which the double bonds are not conjugated with each other. An attempt has been made to detect the influence on general absorption of two unsaturated groups placed far apart in a chain, but near together in space; the results, however, have not been positive.

159. "New derivatives of aminolauronic acid." By John Weir.

In the course of a research, the objects of which were: (1) the preparation of the camphor analogue of indigo,

$$C_8H_{14}\begin{<}{CO\\NH}{>}C{:}C\begin{<}{CO\\NH}{>}C_8H_{14},$$

and (2) the preparation of a diaminocamphor, $NH_2{\cdot}C_8H_{14}{\cdot}NH_2$, the following new compounds have been obtained.

(1) *Carboxymethylaminolauronic acid*, $CO_2H{\cdot}C_8H_{14}{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, a crystalline solid, melting at 183—184°, and having $[\alpha]_D^{18°}$ in water +45·7°.

(2) N-*Anhydrocarboxymethylaminolauronic acid*,

$$C_8H_{14}\begin{<}{CO\\N}{\cdot}CH_2{\cdot}CO_2H,$$

a crystalline solid, melting at 142—143°, and having $[\alpha]_D^{19°}$ in water −22·2°, in alcohol −11·6°, and in benzene −22·2°.

(3) *Anhydromethylaminolauronic acid*, $C_8H_{14}\begin{<}{CO\\NMe}$, an orange-coloured wax.

(4) *Benzoylaminolauronic acid*, $CO_2H{\cdot}C_8H_{14}{\cdot}NHBz$, a crystalline solid, melting at 204°, and having $[\alpha]_D^{19°}$ in alcohol −18·4°.

(5) *Methyl benzoylaminolauronate*, a crystalline solid, melting at 88—89°, and having $[\alpha]_D^{18°}$ in alcohol −28·9°.

(6) N-*Anhydrobenzoylaminolauronic acid*, $C_8H_{14}\begin{<}{CO\\NBz}$, a crystalline solid, melting at 71—72°, and having $[\alpha]_D^{18°}$ in alcohol −69·1°.

The two main objects of the work were not realised.

160. "The triazo-group. Part XVIII. β-Triazoethylamine." By Martin Onslow Forster and Sidney Herbert Newman.

β-Triazoethylamine, $N_3{\cdot}CH_2{\cdot}CH_2{\cdot}NH_2$, obtained from the product of heating β-bromoethylamine hydrobromide with sodium azide, is a colourless oil, which distils at 63·5°/50 mm., and has D^{16} 1·0488. It is reduced to ethylenediamine by stannous chloride in hydrochloric acid. The *hydrochloride*, with the *benzoyl*, p-*toluenesulphonyl*, *phthalyl*, and p-*nitrobenzylidene* derivatives, have been prepared, together with the *carbamide*, *phenylcarbamide*, and *phenylthiocarbamide*.

Unlike the corresponding halogen derivatives, β-triazoethylamine is not converted into dimethyleneimine by the action of the alkalis, thus offering an unusual contrast between the azoimide complex and the halogen atoms.

161. "The interaction of metallic oxides and phosphoryl chloride, alone and in the presence of certain organic compounds." By Henry Bassett, jun., and Hugh Stott Taylor.

Several metallic oxides react readily with phosphoryl chloride to give well defined double compounds. The following have been obtained: $CaO,2POCl_3$; $CaO,3POCl_3$; $MgO,2POCl_3$; $MgO,3POCl_3$; $MnO,3POCl_3$; $ZnO,3POCl_3$. These compounds crystallise well, but are very sensitive to moisture, for which reason they are difficult to obtain quite pure.

All the other oxides investigated (CoO, CdO, CuO, Cu_2O, HgO, Al_2O_3, Fe_2O_3) react more or less readily with phosphoryl chloride, but in these cases large quantities of the metallic chlorides are formed. The mechanism of this chloride formation was discussed, and reasons and experiments were brought forward which favour the view that it is preceded by the formation of an additive compound of the oxide and phosphoryl chloride.

The double compounds of metallic oxides and phosphoryl chloride yield a series of well crystallised derivatives with acetone, ether, and various esters, for example, $CaO,P_2O_3Cl_4,2Me_2CO$;

$MgO,P_2O_3Cl_4,2CH_3{\cdot}CO_2Et$; $MnO,P_2O_3Cl_4,2CH_3{\cdot}CO_2Et$.

These organic derivatives are quite easily obtained by dissolving the appropriate oxide in a solution of phosphoryl chloride in acetone, ethyl acetate, etc. Hydrogen chloride is liberated owing to the action of traces of moisture with formation of these derivatives of the compound $P_2O_3Cl_4$. Their ready formation supports the view that this compound is one of the first products of the action of moisture on phosphoryl chloride.

162. "A copper derivative of quinol." By Hugh Vernon Thompson.

An investigation into the effect of organic oxidising agents on copper showed that a solution of *p*-benzoquinone in ethyl acetate containing traces of acetic acid readily attacks copper.

The first product of the reaction is normal copper acetate, $Cu(C_4H_6O_4),H_2O$, whilst after prolonged immersion the copper becomes coated with a crystalline deposit varying in colour from orange-red to brick-brown, and the solution also turns a red colour.

Subsequent work showed that the deposit could be obtained in crystalline pellets of a deep port-wine colour by dissolving a little *p*-benzoquinone in 30 c.c. of ethyl acetate to which 4 to 5 drops (about 0·07 gram) of glacial acetic acid had been added; in this

solution thin copper foil is placed so as to be only partly immersed, and the temperature kept at 10—15° for one or two days. The substance cannot be purified by ordinary means owing to its insolubility or instability in common solvents; the mean value calculated from a series of analyses gave C = 30·61; H = 3·57; Cu = 33·16 per cent., corresponding with an empirical formula, $C_5H_7O_4Cu$.

Since the initial product in the reaction is copper acetate, it is probable that the red deposit is a molecular compound containing copper acetate, in which case the molecular formula must be at least twice the empirical formula, namely, $C_{10}H_{14}O_8Cu_2$. If we assume that this is the correct molecular formula, the composition can be expressed as:

(*a*) $C_6H_6O_2,CuO,Cu(C_4H_6O_4),H_2O$,
or (*b*) $C_6H_6O_2Cu,Cu(C_4H_6O_4),2H_2O$.

That the substance is a molecular compound of hydrated copper acetate and a copper derivative of quinol follows from the facts that decomposition by glacial acetic acid in ether gives quinol and the salt $Cu(C_4H_6O_4),H_2O$, and that on gently heating the compound in an atmosphere of carbon dioxide *p*-benzoquinone and water are liberated, leaving a residue of metallic copper and anhydrous copper acetate.

The compound can be obtained in small amounts by other methods, but the quinol derivative has not yet been isolated from the copper acetate.

Nitric acid reacts with this compound to give a yellow, crystalline substance, which is either a mixture of copper picrate and copper oxalate of approximately constant composition, or a molecular compound of the two salts of the composition:

$2[(C_6H_2O_7N_3)_2Cu,5H_2O],7(C_2O_4Cu,H_2O)$.

163. "The action of salt solutions and of sea-water on iron at various temperatures." By John Albert Newton Friend and Joseph Hallam Brown.

The authors exposed thin plates of pure iron to the corrosive action of various concentrations of common salt and of sea-water at different temperatures. Below 13° it was found that dilute solutions exert a more corrosive action than distilled water at the same temperature; above 13°, on the other hand, they exert a less corrosive action. At 13° the corrosive action is practically the same for dilute solutions of common salt, for ordinary sea-water, and for distilled water. This temperature is therefore styled by the authors the "Inversion Temperature."

164. "Some derivatives of gelsemine." By Charles Watson Moore.

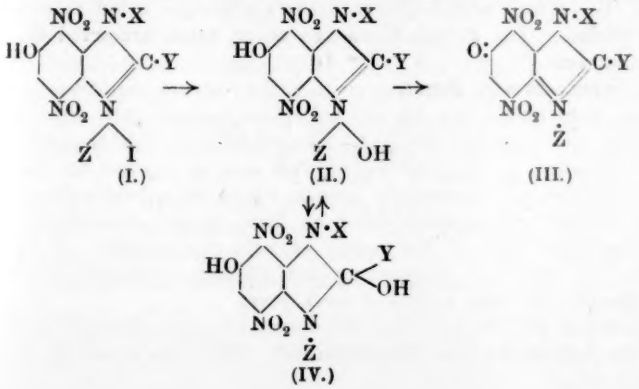
Gelsemine, $C_{20}H_{22}O_2N_2$, is stable towards alkali hydroxides and reducing agents. By treatment with oxidising agents, on the other hand, the molecule is decomposed, and no definite products have been obtained by this means.

On boiling gelsemine with concentrated hydrochloric acid for some hours, three new bases are formed, which have been designated as apo*gelsemine*, isoapo*gelsemine*, and *chloro*-isoapo*gelsemine*. Of these, *apo*gelsemine, $C_{20}H_{24}O_3N_2$, is the chief product of the reaction, and although it cannot be crystallised, it yields well characterised, crystalline derivatives. Chloro-*isoapo*gelsemine, $C_{20}H_{23}O_2N_2Cl$, and its hydrolytic product, *isoapo*gelsemine, $C_{20}H_{24}O_3N_2$, are only formed in relatively small amounts. Both these bases crystallise readily, and they, and several of their derivatives, have been characterised.

It has also been observed that when *gelsemine methyl hydroxide* is heated at 200° in aqueous solution, the expected gelsemethine is not produced, the methyl hydroxide losing methyl alcohol with regeneration of gelsemine.

165. "Syntheses with phenol derivatives containing a mobile nitro-group. Part IV. Quinone-imides, asymmetric quaternary ammonium compounds, and asymmetric carbinols." By Raphael Meldola and Harold Kuntzen.

Setting out from the iminazoles obtained by the action of primary amines on trinitroacetylaminophenol, it was shown that iminazolium iodides (I) can be obtained by heating the iminazoles with alkyl iodides, the resulting compounds being hydrolysable with the formation of the iminazolium hydroxides (II). The latter, on heating, lose water, and pass into quinone-imides (III), and on solution in alkali are transformed into the isomeric carbinols (IV):



It was pointed out that compounds of the types I and II contain an asymmetric nitrogen atom of the form O:N a b c, and should therefore be resolvable into optically active antipodes. The carbinol form (IV) also contains an asymmetric carbon atom, and should be resolvable. As the carbinols and iminazolium hydroxides are interconvertible, the interesting possibility is thus offered of transferring optical activity from a nitrogen to a carbon atom. Type III represents a new class of quinone-imide derivatives, for which the authors propose the name of *iminazolones*. The carbinols (IV) are named, in accordance with precedent, *iminazolols*. Several compounds of each series were described.

166. "Note on a colour change in β-paranitrophenol brought about by sunlight." By Thomas Vipond Barker.

p-Nitrophenol yields two modifications which have been examined crystallographically by the author (*Zeitsch. Kryst. Min.*, 1907, **44**, 159). The two modifications possess great similarity in the values of their prism angles; that they are quite distinct, however, follows from the observed transformation of one into the other on heating under the microscope. The transition temperature, if one really exists, has not been accurately determined, but the author's observations would seem to point to a temperature of 63°, for a saturated toluene solution yields crystals of either modification according as the temperature is above or below 63°. That modification which appears at high temperatures will henceforth be termed α, the other β.

The α-modification is almost colourless, being of a very pale lemon-yellow tint. The β-modification, on the other hand, is of a pronounced yellow colour; but on allowing it to remain for some time the crystals were found to acquire gradually a red tinge on the surface. The α-crystals, on the other hand, preserved their original tint.

Experiments were therefore made under varying conditions, and it was soon found that the red coloration appears only when the crystals are exposed to sunlight. The brighter the light the quicker is the change; in dull weather crystals may be exposed for many days without any appreciable change, whilst on a bright day the red coloration is apparent after an hour or so. Absolutely no change takes place if the crystal be kept in the dark. A tube which has been kept wrapped up in black paper presents no trace of change, even after a lapse of seven years.

It was at first thought that the coloration might possibly be due to the formation of an ammonium salt. That this is not the case

is proved by the fact that the change proceeds in a desiccator over sulphuric acid, and again when the desiccator is filled with hydrogen or carbon dioxide. The change, although quickly enough detected by the eye, must in reality be a very slow process, since crystals after some months' exposure still present a yellow nucleus, and it is likely that the red material acts as a protection against further change by absorbing the actinic rays.

It is very remarkable that the α-modification is wholly unacted on. Of this there can be no doubt, as the following will show. Solutions in water at the ordinary temperature yield crystals, the great majority of which are those of the β-modification, but, in addition, some crystals of the α-modification also appear. Owing to the similarity in habit, it is often impossible without an actual measurement on the goniometer to distinguish between crystals of the two modifications. The whole of one crop thus obtained was collected into a tube, and exposed to sunlight for some time; all the crystals with the exception of two turned red after a few hours. The action was allowed to proceed for a few months; but even after this prolonged treatment the two crystals still failed to show the slightest trace of change. They were therefore taken out, and measured on the goniometer, and proved to be crystals of the α-modification. A few of the red crystals selected at random proved on measurement to be those of the β-modification.

Commercial *p*-nitrophenol consists of a mixture of both kinds of crystals, and on examination it will generally be found that some are red whilst others are not. The former are those of the β-modification.

Cases of colour change have previously been observed, but as far as the author is aware, no case has previously been discovered in which the change is restricted to one crystalline modification. At present the usually accepted view with regard to polymorphous modifications is that the difference in crystalline form is not due to a difference in the chemical molecule, but rather in the different mode of packing of the molecules. The above remarkable difference of behaviour, however, of the two "polymorphous" modifications of *p*-nitrophenol would seem to argue for a difference in chemical structure; it is difficult to see how a mere difference in the arrangement of the same chemical molecules should render one crystal structure immune to the action of actinic rays. It is therefore suggested that the chemical structures of the α- and β-modifications of *p*-nitrophenol are different.

167. "The sensitiveness of pentamminenitrosocobalt salts to light." By Oskar Krafft Heinrich Burger.

In purifying the red variety of pentamminenitrosocobalt nitrate (Sand and Genssler, *Ber.*, 1903, **36**, 2083; *Annalen*, 1903, **329**, 194) by crystallisation from water, it was noticed that the deep red solution is sensitive to light, and is slowly decomposed with the formation of nitric oxide and a green flocculent precipitate of cobaltous hydroxide. This decomposition cannot well be explained but by the assumption that the red salt changes under the influence of light into the black isomeride considered, by Sand and Genssler, to contain bivalent cobalt, and that the latter is then decomposed by the water. The reaction may be represented by the equation:

$$Co_2(N_2O_2)(NH_3)_{10}(NO_3)_4 + H_2O = Co(OH)_2 + 2NO + 4NH_4NO_3 + 6NH_3.$$

If the solution is kept acid during the decomposition, the same quantity of gas is developed, but no precipitate is formed, the cobalt remaining in solution as cobaltous salt.

A similar decomposition is observed when a solution of the red salt is heated for some time. The development of gas is the same, but instead of the green, flocculent hydroxide a more compact, black cobaltous oxide is formed. That the decomposition in light is really due to the rays of light, and not to those of heat, is shown conclusively by the fact that the more refrangible end of the spectrum only produces the reaction.

A determination of the solubility in water of the red nitrate showed that one part of the salt dissolves in about twenty-five parts of water. For the purpose of identifying the gas evolved in the reaction, a few c.c. of an acidified solution of the red nitrate were placed on top of the mercury in a eudiometer, and subjected for several hours to the action of direct sunlight. It was found advantageous to have the solution acidified, because otherwise the gas bubbles become attached to the flocculent precipitate, and do not separate easily. The acid merely serves to prevent the formation of cobaltous hydroxide, otherwise the reaction proceeds in exactly the same way. The slow liberation of gas was the only sign of the change taking place. No variation of colour could be observed, as the colour of the red cobaltic nitrate in solution is almost the same as that of a cobaltous salt. The gas evolved was proved to be nitric oxide.

The following short account of a series of experiments will give an idea of the velocity of the reaction. Four flat porcelain dishes of about 8 cm. diameter were charged with 10 c.c. each of a solution containing 1·620 grams of the red nitrate per 100 c.c.

They were all exposed at the same time to direct sunlight (the sun being close to the zenith), and successively withdrawn at intervals of five minutes. The precipitate formed was collected in the dark, the filtrate evaporated with sulphuric acid, and the cobalt sulphate weighed.

10 c.c. of the original solution contained						0·1620	gram of nitrate.	
10 c.c. contained after	5	minutes'	exposure			0·0988	„	„
„ „	„	„	10	„	„	0·0828	„	„
„ „	„	„	15	„	„	0·0704	„	„
„ „	„	„	20	„	„	0·0698	„	„

It is evident that the reaction slows down as the solution becomes more dilute, and the soluble products of the reaction (ammonia and ammonium nitrate) accumulate in the solution.

The spectrum of the red solution shows only general absorption of the more refrangible part from the green onwards. As would be expected, only those rays that are absorbed will produce decomposition. Solutions of the red nitrate of equal strength were exposed to sunlight covered with red, yellow, green, and blue glasses respectively. After several days' exposure, the solution under the red and yellow glass did not show any sign of decomposition, that under the green filter only a slight one, whereas the solution under the blue glass was decomposed to a considerable extent.

It was suggested that the solution of the red nitrate might be used with advantage for the construction of a chemical photometer.

168. "Lecture experiment to illustrate dust explosions. The surface areas of certain finely-divided combustible solids." By William Robert Lang and Hoyes Lloyd.

The following experiment serves as an illustration of the liability to explosion of the dust from starch and from coal when mixed with air. A glass cylinder, about seven feet long and four inches wide and open at both ends, is set up vertically, wires from an induction-coil being led through glass tubes into the middle of the chamber. Lycopodium, starch, and coal-dust, when allowed to fall into the tube and a spark passed through the mixture, ignite with explosive violence, the combustion being propagated throughout the length of the tube, and the flames issuing a considerable distance from either end. Direct application of a lighted taper produces the same result.

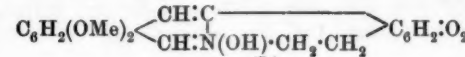
With the view of arriving at some approximate idea of the total surface of the combustible matter exposed to the air in such cases, the dimensions of the particles of the substances employed were

ascertained by a microscopic examination, and the surface-area per 100 grams of each calculated. In like manner, "pyrophoric carbon" and pyrophoric iron were examined, and similar calculations made. The results may be summarised as follows:

Substance.	Mean diameter of particles in millimetres.	Total surface area for 100 grams of substance.
Lycopodium	0·028	20·92 square metres.
Maize starch	0·0122	32·78 ,, ,,
Coal dust: *a.* medium	0·012	33·33 ,, ,,
Coal dust: *b.* fine	0·0016	250·00 ,, ,,
"Pyrophoric carbon"	0·00125	332·00 ,, ,,
Pyrophoric iron	0·0054	15·08 ,, ,,

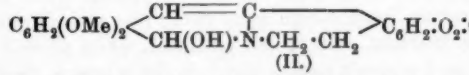
169. "The constitution of berberine." By Charles Kenneth Tinkler.

From an examination of the ultra-violet absorption spectra of berberine and its simple derivatives, evidence has been obtained of the existence of two modifications of the alkaloid in the solid state. Berberine crystallised from water gives spectra in aqueous, alcoholic, and also in chloroform solution, which are identical with those of the berberine salts, and from this agreement the substance would appear to have an ammonium-base constitution as represented by formula (I) (compare Perkin, *Trans.*, 1910, **97**, 321):



(I.)

A solution of the substance containing alkali, however, gives spectra which agree closely with those of Freund and Beck's methyldihydroberberine, and the same spectra are given by a chloroform and an ethereal solution of berberinal, the substance precipitated by the addition of sodium hydroxide to an aqueous solution of berberinium hydroxide. This agreement can only be explained by assigning to berberinal the carbinol formula (II), and the name *berberinol* is suggested for this substance:



(II.)

The transformation of berberinol into berberinium hydroxide is readily followed by means of the spectroscope.

Spectroscopic evidence was also obtained in support of the view that the products of decomposition of berberinol by excess of alkali are dihydroberberine and oxyberberine.

Since both modifications of the alkaloid can be obtained in

solution in chloroform, it appears that both the ammonium base and the carbinol exist in the solid state. In this respect berberine differs from the other substances that have been investigated in connexion with the carbinol–ammonium base–aldehydeamine isomerism, in which cases evidence of the existence of the carbinol form alone in the solid state has been obtained.

170. "Triketohydrindene hydrate. Part IV. Hydrindantin and its analogues." By Siegfried Ruhemann.

Hydrindantin has been shown to yield a red solution with sodium carbonate and a blue solution with sodium hydroxide (*Trans.*, 1911, **99**, 792). An examination of these shows that the red salt is a salt of hydrindantin, and the blue sodium compound is a chromo-salt of the hydrolytic product of hydrindantin, namely, hydroxy-diketohydrindene, $C_6H_4\langle\begin{matrix}CO\\CO\end{matrix}\rangle CH\cdot OH$. This substance, which is to be regarded as the analogue of dialuric acid, could not be obtained pure, because it is readily oxidised to hydrindantin. Owing to the close resemblance of hydrindantin to alloxantin, the violet barium compound which this substance yields with baryta is to be regarded as a chromo-salt of dialuric acid, instead of alloxantin. The author also considers that isatide is an analogue of alloxantin, and that, therefore, it must be represented thus:

$$\begin{matrix}C_6H_4\\NH\cdot CO\end{matrix}\rangle CH\cdot O\cdot C(OH)\langle\begin{matrix}C_6H_4\cdot NH\\|\\CO\end{matrix}$$

(compare Heller, *Ber.*, 1904, **37**, 946). Further, it was found that dialuric acid does not unite with triketohydrindene hydrate to form an analogue of alloxantin, but that the acid reduces the triketone to hydrindantin. This substance is also produced from oximino-diketohydrindene, $C_6H_4\langle\begin{matrix}CO\\CO\end{matrix}\rangle C{:}NOH$, by means of concentrated hydriodic acid; on using stannous chloride, instead of hydriodic acid, the analogue of uramil, namely, diketohydrindamine, $C_6H_4\langle\begin{matrix}CO\\CO\end{matrix}\rangle CH\cdot NH_2$, is formed.

171. "Aminoquercetin." (Preliminary note.) By Edwin Roy Watson.

An *aminoquercetin* has been obtained from quercetin by completely methylating to protect the molecule, nitrating, reducing, and demethylating.

Nitropentamethylquercetin, $C_{15}H_4O_2(OMe)_5 \cdot NO_2$, prepared by dissolving pentamethylquercetin in cold nitric acid (D 1·4), crystallises from acetone in bright yellow, needle-shaped crystals, melting at 202—204°.

Aminopentamethylquercetin, $C_{15}H_4O_2(OMe)_5 \cdot NH_2$, prepared by reducing the nitro-compound with tin and alcoholic hydrochloric acid, crystallises from benzene in almost white, stout prisms, melting at 200—202°. Its *hydrochloride* crystallises from dilute hydrochloric acid in white, needle-shaped crystals, and its *sulphate* from dilute sulphuric acid also in white, needle-shaped crystals. An *acetyl* derivative crystallises from alcohol and acetic acid in stout, white prisms, melting at about 223—226°.

Aminoquercetin, $C_{15}H_4O_2(OH)_5 \cdot NH_2$, is obtained in solution as hydriodide on boiling either aminopentamethylquercetin or nitropentamethylquercetin with hydriodic acid (D 1·7). The free base is isolated in light yellow, needle-shaped crystals by decomposing its salts with pyridine and water. The *hydrochloride*,

$$C_{15}H_{11}O_7N,HCl,$$

crystallises from dilute hydrochloric acid in yellow, fine needle-shaped crystals, the *hydriodide* from dilute hydriodic acid in orange-coloured warts, and the *sulphate* from dilute sulphuric acid in yellowish-brown warts. An *acetyl* derivative, crystallising from alcohol and acetic acid in white rhombs, melting at 151—153°, is obtained by acetylation of either aminoquercetin or its salts; it is either the hexa- or the hepta-acetyl derivative.

Aminoquercetin dyes mordanted wool the following shades: brown on chrome, yellow-brown on alum, orange-red on tin, and brownish-black on iron. The shades are browner and deeper than corresponding dyeings with quercetin.

In the course of this investigation, the following quercetin derivatives have also been prepared:

Pentamethylquercetin hydrochloride, $C_{20}H_{20}O_7,HCl$, *hydrobromide*, $C_{20}H_{20}O_7,HBr$, *sulphate*, $C_{20}H_{20}O_7,H_2SO_4$, and *nitrate*, $C_{20}H_{20}O_7,HNO_3$. The first three of these oxonium salts are obtained in bright yellow, needle-shaped crystals on adding a concentrated solution of the corresponding acid to a solution of pentamethylquercetin in glacial acetic acid, and the nitrate is obtained, also in bright yellow needles, by adding concentrated nitric acid to a solution of pentamethylquercetin in absolute alcohol.

Trinitropentamethylquercetin, $C_{15}H_2O_2(OMe)_5(NO_2)_3$, prepared by dissolving pentamethylquercetin in cold fuming nitric acid, is a canary-yellow substance, melting at 190—205°.

Dibromopentamethylquercetin, $C_{15}H_3O_2Br_2(OMe)_5$, prepared by

brominating pentamethylquercetin in glacial acetic acid solution, crystallises from alcohol or benzene in white, short prisms or leaflets arranged in sheaves, melting at 173—175°.

Dibromopentamethylquercetin hydrobromide, $C_{20}H_{18}O_7Br_2,HBr$, is obtained in bright yellow, needle-shaped crystals as an intermediate compound in the bromination of pentamethylquercetin.

Dibromonitropentamethylquercetin, $C_{15}H_2O_2Br_2(OMe)_5{\cdot}NO_2$, prepared by dissolving dibromopentamethylquercetin in cold nitric acid (D 1·4), crystallises from alcohol or acetone in light yellow rhombs, melting at 173—175°.

Pentamethylquercetindiazonium chloride, $C_{15}H_4O_2(OMe)_5{\cdot}N_2Cl$, is obtained in bright yellow, needle-shaped crystals on diazotising aminopentamethylquercetin hydrochloride.

Pentamethylquercetindiazonium sulphate separates in yellow, needle-shaped crystals on adding dilute sulphuric acid to a cold saturated aqueous solution of the corresponding diazonium chloride.

Pentamethylquercetinazo-β-naphthol,

$$C_{15}H_4O_2(OMe)_5{\cdot}N_2{\cdot}C_{10}H_6{\cdot}OH,$$

prepared by mixing an alkaline solution of β-naphthol and a solution of pentamethylquercetindiazonium chloride, crystallises from glacial acetic acid in deep crimson, needle-shaped crystals, melting and decomposing at 211°.

The amino-group in aminoquercetin is probably in the catechol nucleus in that position which is para- with respect to one of the hydroxyl groups and meta- to the other, but experiments are in hand to determine its position definitely. Experiments are also in progress to convert aminoquercetin into the corresponding hydroxyquercetin, and from the compounds now described to prepare other derivatives with dyeing properties.

172. "The reduction of nitroacenaphthene." By Holland Crompton and Maggie Walker.

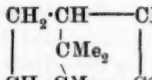
The methods suggested by Quincke (*Ber.*, 1888, **21**, 1454) and by Graebe (*Annalen*, 1903, **327**, 81) for the reduction of nitroacenaphthene are slow, and were not found to give good yields of aminoacenaphthene. Better results were obtained on using zinc dust and water as a reducing agent.

Nitroacenaphthene is mixed intimately with about five times its weight of zinc dust, and sufficient water is added to form a thin paste. The mixture is heated for ten hours on a water-bath, then dried at about 60°, and extracted with light petroleum. The aminoacenaphthene obtained on distilling off the solvent is slightly brown,

owing to the presence of a small quantity of a brown-coloured by-product, which has not been further examined. It can be purified by treatment with dilute sulphuric acid. It is best to crystallise out the sulphate, as this salt is more stable on exposure to air than is the free base. The yield in the above process is about 60 per cent. of the theoretical.

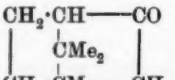
173. "Epicamphor: a new isomeride of camphor." (Preliminary note.) By Frederick Russell Lankshear and William Henry Perkin, jun.

Two keto-derivatives should be obtainable from camphane, namely:



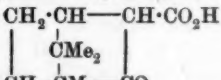
Camphor.

and

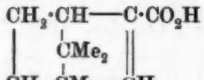


Epicamphor.

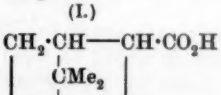
and of these the second, for which the name *epicamphor* is proposed, has not yet been described. Owing to the interest attaching to this substance, one of the authors has for some years attempted to prepare it, but, until recently, without success. It may be obtained by the following series of reactions. Camphorcarboxylic acid (I) is converted by reduction and subsequent elimination of water into bornylenecarboxylic acid (II), and the authors have observed that this acid is converted by reduction with palladium and hydrogen quantitatively into camphanecarboxylic acid (III) (compare Bredt, *Annalen*, 1909, **366**, 60). This saturated acid is readily brominated when its chloride is warmed with bromine on the steam-bath, and the bromo-ester obtained by pouring the bromo-acid chloride into alcohol is next digested with potassium acetate in acetic acid solution. After hydrolysis with alcoholic potassium hydroxide, the α-hydroxycamphanecarboxylic acid (IV) is oxidised by lead peroxide, permanganate, or also by chromic acid, and, in each case, small yields of epicamphor are obtained.



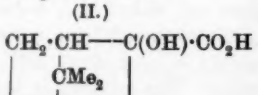
(I.)



(II.)



(III.)



(IV.)

Epicamphor is readily volatile in steam, has the same odour as camphor, and is remarkably like this substance in almost all its properties; it melts at about 165°, but this melting point, as well as the others mentioned in this paper, will be carefully revised when larger quantities of material are available.

Found: C=78·3; H=10·5. $C_{10}H_{16}O$ requires C=79·0; H=10·4 per cent.

Epicamphoroxime melts at about 102°, and has the same odour as camphoroxime, which melts at 119°. (Found, C=72·3; H=10·4; N=8·6. $C_{10}H_{17}ON$ requires C=71·8; H=10·2; N=8·4 per cent.) *Epicamphorsemicarbazone* separates from benzene in flocks and from methyl alcohol in glistening needles, and melts at 225—227° with effervescence, whereas camphorsemicarbazone melts at 236—238°. (Found, N=20·1. $C_{11}H_{19}ON_3$ requires N=20·1 per cent.)

The authors intend to prepare a number of derivatives of epicamphor with the object of comparing them with the corresponding derivatives of camphor.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Blücher, *H.* Modern industrial chemistry. Translated by *J. P.* **Millington.** pp. xvi + 779. ill. London 1911. (*Reference.*)
From the Publishers: The Gresham Publishing Company.

Edge, *John Harold.* Notes on practical cotton finishing. pp. 103. ill. London 1911. (*Recd.* 9/5/11.) From the Author.

Fowler, *Gilbert John.* An introduction to bacteriological and enzyme chemistry. pp. viii + 328. ill. London 1911. (*Recd.* 26/5/11.)
From the Author.

Körner, *Wilhelm.* Über die Bestimmung des chemischen Ortes bei den aromatischen Substanzen. (Ostwald's *Klassiker*, No. 174.) Leipzig 1910. (*Recd.* 30/5/11.) From the Author.

Ostwald, *Wilhelm.* Introduction to chemistry. Authorized translation by *William T.* **Hall** and *Robert S.* **Williams.** pp. ix + 368. ill. New York 1911. (*Recd.* 28/4/11.)
From the Publishers: Messrs. John Wiley and Sons.

II. *By Purchase.*

Bang, *Ivar.* Chemie und Biochemie der Lipoide. pp. xi + 187. Wiesbaden 1911. (*Recd.* 17/5/11.)

Hopkins, *Cyril George.* Soil fertility and permanent agriculture. pp. xxiii + 653. ill. Boston 1910. (*Recd.* 25/5/11.)

May, *Percy.* The chemistry of synthetic drugs. pp. xiii + 229. London 1911. (*Recd.* 25/5/11.)

Roberts-Austen, *Sir William Chandler.* An introduction to the study of metallurgy. 6th edition, revised and enlarged by *F. W.* **Harbord.** pp. xv + 478. ill. London 1910. (*Recd.* 25/5/11.)

Thiel, *A.* Der Stand der Indikatorenfrage. Zugleich ein Beitrag zur chemischen Theorie der Farbe. (Sammlung, Vol. XVI.) Stuttgart 1911.

Tutton, *Alfred Edwin Howard.* Crystallography and practical measurement. pp. xiv + 946. ill. London 1911. (*Recd.* 25/5/11.)

Wehmer, *C.* Die Pflanzenstoffe. Chemische Bestandteile und Zusammensetzung der einzelnen Pflanzenarten, Rohstoffe und Produkte. pp. xvi + 937. Jena 1911. (*Recd.* 17/5/11.)

Werner, *A.* New ideas on inorganic chemistry. Translated by *Edgar Percy* **Hedley.** pp. xvi + 268. London 1911. (*Recd.* 25/5/11.)

Zeitschrift für angewandte Chemie. General Register. Jahrgänge 1887 bis 1907. Edited by *Berthold* **Rassow** and *Ernst Wolfgang* **Müller.** pp. iv + 609. Leipzig 1910. (*Reference.*)

III. *Pamphlets.*

Autenrieth, *Wilhelm,* and **Tesdorpf,** *Theodor.* Über eine kolorimetrische Bestimmung des Traubenzuckers im Harn. (From the *Münch. med. Woch.*, 1910, **37**.)

Beck, *Karl,* and **Stegmüller,** *Ph.* Über die Löslichkeit von Bleisulfat und Bleichromat für sich, in Gemischen und in Form von Ölfarben in verdünnter Salzsäure, sowie über das Gleichgewicht von Chromat und Bichromat in Lösung. (From the *Arb. K. Gesundh.-Amt,* 1910, **34**.)

Calliess, *Franz Wilhelm.* Über Ephedrin und Pseudoephedrin. (From the *Apoth. Zeit.*, 1910, **25**.)

Clacher, *William.* Some notes on animal charcoal. (From the *Int. Sugar J.*, 1910.)

Comanducci, *Ezio.* Tallochinina. pp. 7. Napoli 1910.

Coventry, *Bernard.* Report on the progress of agriculture in India for 1909–10. pp. 106. Calcutta 1911.

Dibdin, *William Joseph.* Notes of lecture on mortar and cement. pp. 32. London 1911.

Fischel, *Richard.* Der histochemische Nachweis der Peroxydase. (From the *Wien. klin. Woch.*, 1910, **23.**)

Forssner, *Gunnar.* Über die Einwirkung des Nahrungsfettes auf die Acetonkörperausscheidung. (From the *Skand. Archiv. Physiol.*, 1910, **23.**)

Fouard, *Eugène.* L'état colloïdal de l'amidon et sa constitution physicochimique. pp. 147. Laval 1911.

Gaebel, *Gustav Otto.* Das Reischauersche Titrationsverfahren zur Bestimmung des Harnzuckers. (From the *Apoth. Zeit.*, 1910, **25.**)

Gazzetti, *C.*, and **Sarti**, *C.* Intorno ad una reazione rossa del reattivo di Esbach. (From the *Arch. farm. sperim. Sci.*, 1910, **9.**)

Gray, *George.* On the dissolved matter contained in rain water collected at Lincoln, New Zealand. (From the *Canterbury Agric. Coll. Mag.*, 1910).

Hämäläinen, *Juho.* Über das Schicksal des Cineols (Eukalyptols) im Organismus. (From the *Skand. Arch. Physiol.*, 1910, **24.**)

Hämäläinen, *Juho*, and **Sjöström**, *Lennart.* Über den Umfang der Glykuronsäurepaarung bei enzymimmunisierten Kaninchen. (From the *Skand. Arch. Physiol.*, 1910, **24.**)

Henderson, *Velyen E.* Hemmung der Wirkung chemischer Muskelreize durch Anelektrolyte. (From the *Zentr. Physiol.*, 1910, **24.**)

Javillier, *M.* Sur les silicotungstates de conicine, de spartéine et d'atropine. (From the *Bull. Sci. Pharm.*, 1910, **17.**)

Kinoshita, *Tosaku.* Über das Auftreten und die quantitative Bestimmung des Trimethylamins im menschlichen Harn. (From the *Zentr. Physiol.*, 1910, **24.**)

Lauder, *Alexander*, and **Fagan**, *T. W.* The variation in the composition of milk. Fifth annual report. pp. 42. Edinburgh 1911.

Loew, *Oscar.* Über die physiologische Rolle der Kalziumsalze. (From the *Münch. Med. Woch.* 1910.)

—— Über die Wirkung von Strontiumsalzen auf Algen. (From *Flora*, 1911, **102.**)

Loew, *Oscar*, and **Bokorny**, *Th.* Aktives Eiweiss und Tannin in Pflanzenzellen. (From *Flora*, 1911, **102.**)

Miculicich, *Miroslav.* Über den Einfluss von Elektrolyten und Anelektrolyten auf die Permeabilität der roten Blutkörperchen. (From the *Zentr. Physiol.*, 1910, **24.**)

Moreau, *B.* Analyse quantitative d'un mélange de sels, de recherche particulièrement difficile. (From the *Bull. Sci. Pharm.*, 1910.)

Pohl, *Julius.* Experimenteller Beitrag zum Oxalsäurestoffwechsel. (From the *Zeitsch. exp. Path.*, 1910, **8.**)

THE FARADAY LECTURE.

The Faraday Lecture, entitled, "The Fundamental Properties of the Elements," will be delivered by Professor Theodore W. Richards, of Harvard University, on Wednesday, June 14th, 1911, at 8 p.m.

The Lecture will be given, by the kind permission of the Managers, in the theatre of the Royal Institution, 21, Albemarle Street, W.

Admission will be by ticket only. Each Fellow of the Society is entitled to two tickets which may be obtained on application to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Scientific Meeting on **Thursday, June 15th**, 1911, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"The alleged complexity of tellurium." By A. G. Vernon Harcourt and H. B. Baker.

"The purification and properties of acetic acid." By W. R. Bousfield and T. M. Lowry.

"Cupriglycollates." By S. U. Pickering.

"The solubility of carbon dioxide in beer." By A. Findlay and B. Shen.

"An addition to the Buchner funnel." By A. C. G. Egerton.

"Polymorphic phthalylhydrazides." By F. D. Chattaway and D. F. S. Wünsch.

"The decomposition of hydrazides and hydrazones by heat." By F. D. Chattaway, C. Cumming, and B. H. Wilsdon.

"Note on gum kino." By J. L. Simonsen.

"The action of ammonia and amines on 2-phenyl-1 : 3-benzoxazine-4-one." By A. W. Titherley and E. C. Hughes.

"Electromotive forces in alcohol. Part I. Concentration cells with electrodes reversible to chlorine ions." By A. Lapworth and J. R. Partington.

"Some oxidation products of the hydroxybenzoic acids. Part III." By A. G. Perkin.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, June 15th, 1911.

Atkins, Ernest Andrew,
71, East Hill, Wandsworth, S.W.

Pharmaceutical Chemist. Have had one year's experience as Student in Laboratory, and also have studied successfully for Minor and Major Pharmaceutical Qualifications. Am desirous of keeping up-to-date in my knowledge of pure Chemistry, more especially in its application to Pharmacy.

James D. Kettle.	*Alexander Scott.*
C. F. Baker.	*John W. Heath.*
C. Edwd. Sage.	*S. Bosworth.*

Atkinson, Norman Ernest,
Ash Cottage, Thornhill Lees, Dewsbury.

Works manager. Six years Portland Cement Works' Chemist. At present, Manager of Calcium Carbide Works.

Walter M. Gardner.	Walter F. Reid.
A. Battye Knaggs.	H. S. Raper.

Barker North.

Blackhurst, Arthur Owen,
"Downing," Broughton, Preston.

Agricultural Demonstrator. I am desirous of keeping in touch with chemical developments. National Diploma in Agriculture (N.D.A.). A first-class Certificate granted by the Board of Education in the Advanced Agricultural Chemistry Section of the Agricultural Science Examination. Research work on manurial residues of crops for the Potash Syndicate, and in Black Scab of Potatoes for the Board of Agriculture.

R. Henry Jones.	John Robinson.
Allan Baguley.	*Harold B. Dixon.*

Ch. Weizmann.

Bradshaw, George Arthur,

28, Raymond Street, Bury, Lancs.

Teacher of Chemistry. M.Sc. Degree in Chemistry, Victoria University of Manchester, 1908. 1908–9 Science Master, The College, Kilkenny, Ireland. Since 1909 Chemistry Master, the High School, West Leeds.

Harry Ingham. Harold B. Dixon.
Geo. M. Norman. E. C. Edgar.
Ch. Weizmann.

Cooke, Charles Ernest,

35, Sebert Road, Forest Gate, Essex.

Representative of Messrs. J. and R. Griffin, Ltd., Manufacturing Chemists, Kingsway, London. Studied Chemistry at Royal College of Science and at the Hartley University College, Southampton. In 1908 was Science Master at the Grammar School, Shoreham, Sussex.

Chas. W. Truelove. M. O. Forster.
D. R. Boyd. G. T. Morgan.
W. Godden.

Clarke, Arthur Frederick,

12, York Avenue, Gillingham, Kent.

Teacher and Lecturer at Gillingham Technical Institute. Desirous of coming in touch with current scientific literature.

R. C. Farmer. H. R. Redman.
W. H. Gibson. *Robert Robertson*
E. G. Couzens.

Cowling, Thomas,

Easingwold, Yorks.

Teacher. For three years Chemical Student, University College, Nottingham. Hold First-class Certificates in Advanced Chemistry from Board of Education. Interested in Chemical research.

Frederick Cowling. A. H. Salway.
John Thomas Fox. F. Tutin.
Harold Rogerson.

Datta, Ganesh,

Dera Ismail Khan, N.W.F.P., India.

Barrister-at-law and Advocate, Chief Court, Lyallpur. B.A. (Punjab Univ.); M.R.A.C. (Cirencester, England), etc. Graduated in Arts at the University of the Punjab, India, in 1904. Obtained Honours Diploma of Membership at the Royal Agricultural College, England, in April, 1909, after nearly three years' study. Subsequently studied science and practice of dairying at different institutions in England.

Am landowner, manager of my farms, and interested in promoting scientific agriculture.

E. F. Harrison. Ruchi Ram Sahni.
P. D. Sabherwál. Hari Prasad.

Puran Singh.

Demuth, Rudolph,
68, Salusbury Road, London, N.W.

Chemical Technologist. Studied at University of Marburg and Imperial Polytechnicum, Charlottenburg. I was engaged by the Cape Government in experimental work connected with Rinderpest epidemic, especially in regard to the production of chemical anti septics and disinfectants for use in connexion with that and other infectious diseases of cattle. I have also been engaged in Agricultural and Horticultural researches of a chemical nature. In the field of Hygiene I have worked and produced useful apparati—now universally in use, etc., etc.

Peter MacEwan. Alfred Gordon Salamon.
Thos. Tyrer. J. Lewkowitsch.

George T. Holloway.

Gardner, Edgar Harold,
34, Salisbury Avenue, Colchester.

Schoolmaster. Student of Chemistry with the idea of becoming a teacher of the subject. Inter. B.Sc. (Lond.). Engaged with Mr. Neville on Stereoisomeric research for some time.

H. A. D. Neville. Will. T. Boone.
A. W. Nunn. H. P. Wilson.

A. E. Barker.

Ghose, Joges Chandra,
Bhagalpur, Behar, India.

Professor of Chemistry, T.N.J. College, Bhagalpur. M.A. in Chemistry, Class II. ; worked for two years in the Presidency College Chemical Laboratory under Dr. P. C. Rây, D.Sc., Ph.D., and Mr. Cunningham, M.A., F.C.S., A.R.C.S.I. Lecturing on Chemistry for four years.

Atul Chandra Ganguli. *Punchānan Neogi.*
P. C. Rây. *Chuni Lal Bose.*
Bidhu Bhushan Dutt. *Jatindranath Sen.*

Gonville, Cyril Herbert Koszelski, F.R.B.S. (London),
"Milton," Queen's Road, Buckhurst Hill, or 63, The Broadway, Stratford, Essex.

Colouring Specialist; Joint Inventor of a new chemical process for making Caramel. Technical Chemist. Have done considerable work

both in the Study of Chemistry and its Practical Application in Manufacture. Worked out and invented an improved process for Caramel and also for priming Beers, etc. Studied Chemistry both privately and publicly, the latter at Sir John Cass' Institute, and the Chemistry of Brewing under Mr. Ling and under Dr. Harden for Micro-biology.

John Heron. Arthur R. Ling.
Charles A. Keane. Arthur Harden.
H. Burrows. F. R. Holloman.

Goold, Rowland Lewis,

5, Corporation Street, Birmingham.

Registered Patent Agent (by Examination). Associate of the Institution of Electrical Engineers. I am a Patent Agent practising in the firm of Lewis Wm. Goold. In the department of my business relating to Chemical Science I have been engaged in the investigation of principles and analogies in the Chemistry of new manufactures tendered as subject for Letters Patent. I now have the responsible conduct of practically all the more important and more technical of the chemical and cognate matters with which my firm from time to time has to deal. I desire admission to the Society in order that I may follow more closely the progress of Chemical Science.

W. R. Bousfield. Douglas F. Twiss.
T. Slater Price. Arthur Colefax.

E. A. Tyler.

Joseph, Edward Lionel,

96, Victoria Street, S.W.

Managing Director of Ozonair, Limited. Consulting Engineer. Member of the Institution of Electrical Engineers. Inventor and Patentee of about 100 Inventions and Processes connected with Ozone in its various applications, etc., etc.

Leonard Temple Thorne. William A. Tilden.
W. H. Simmons. J. C. Cain.

W. Gordon Carey.

Linenbröker, Henry Edmund,

100, Harrow Road, Paddington.

Wholesale Chemical Manufacturer. Principal of "The Imperieux Laboratories." Intent to advance in Chemical Science. Author of "Blue Book Recipes on Scientific Colouring"; Author of "Das Brevier der Haarfarben Chemie." Contributor to various periodicals.

John T. Furnell. William A. Colebourn.
Frank E. Weston. *W. H. Collier.*

J. Cruickshank Smith.

Ling, **Herbert James**,
Hankow, China.

Chemist (Director Hankow Disp., Ltd.). Pharmacist. Investigations include Chinese Wood Oil, Chinese Bean Oil, Rhubarb, etc. Desirous of keeping in touch with modern research upon these subjects.

E. J. Millard. Thomas Tyler.
John C. Hewlett. *Peter MacEwan.*
H. H. Robins.

Merriman, **Richard William**,
244, Victoria Park Road, South Hackney.

Demonstrator in Chemistry, Guy's Hospital Medical School. M.A. Cambridge, Natural Science Tripos, Parts I and II. Joint Author with Dr. S. Ruhemann of (*a*) "The Action of Phenylpropiolyl Chloride on Ketonic Compounds" (*Trans.*, 1905, **87**, 1384); (*b*) "Tetrazoline. Part III" (*Trans.*, 1905, **87**, 1768). Joint Author with Dr. J. Wade of "The Correction of the Specific Gravity of Liquids for the Buoyancy of Air" (*Trans.*, 1909, **95**, 2174).

S. Ruhemann. J. T. Hewitt.
John Wade. F. G. Pope.
Horace Finnemore.

Paul, **Felix Gabriel, M.R.A.S.E.**,
No. 64, 38th Street, Rangoon, Burma.

Superintendent of Land Records, Burma; at present on leave in England. Calcutta University Entrance Examination; Clerkship Examination of Burma; Higher Survey Examination for the appointment of Land Records officers in Burma. Has experience in the investigation of Chemical Science, especially in connexion with agricultural and other lands in Burma, and the treatment and classification of soils as a Survey and Revenue assessment officer under the British Government for several years.

E. Towyn Jones. Clarence A. Seyler.
J. A. Hatfield. *E. A. Tyler.*
John Williams Bevan.

Pitt, **Leonard Ison**,
109, Abbott Road, Bromley, London, E.

Schoolmaster. Studied Science for four years at the East London College, and obtained First Class Hons. in Chemistry at the London B.Sc. Examination in Oct. '08. Science Master at Stamford School since May '09.

J. T. Hewitt. Clarence Smith.
F. G. Pope. A. D. Mitchell.
F. S. Long.

Walton, Willam Keighley,

"Beechwood," Upper Rushton Road, Thornbury, Bradford.

Analytical Chemist. Since 1903 with F. W. Richardson, F.I.C., City Analyst, Bradford, and West Riding County Analyst, Yorkshire, as chief assistant. Joint author of paper on "Analysis of Camphorated Oil for Camphor Substitutes," *Analyst*, 1908. Later as Research Chemist to Messrs. Richardson and Jaffé, Analysts, Bradford. Conjoint author with Mr. Richardson of paper on "Composition of Turkey Red Oil," shortly to be read.

F. W. Richardson. George H. Martin.
A. Jaffé. Geoffrey A. Bracewell.

Walter M. Gardner.

The following Certificate has been authorised by the Council for presentation to Ballot, under Bye-law I. (3).

Gallsworthy, Benjamin,

Thilawa, Rangoon.

Oil Refiner. At present Chief Refiner to the British Burma Petroleum Co.; previously Chemist to the Indo Burma Petroleum Co., Ltd., and for many years engaged in Chemical work in the Indian Leather Industries.

H. V. Mitchell. *J. T. Hewitt.*

R CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.

[Issued 29/6/11]

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 389.

June 14th, 1911. Extra Meeting, Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair. This meeting was held in the Theatre of the Royal Institution, by kind permission of the Managers.

The PRESIDENT, in opening the proceedings, said: We are gathered together in this historic chamber to celebrate what has come to be one of the most important festivals in the Calendar of the Chemical Society, the delivery of the Faraday Lecture, the presentation of the Faraday Medal. The high significance of this meeting is most effectively realised if we call to mind the names of the illustrious men who have functioned as Faraday lecturers in the past. Dumas, Cannizzaro, Hofmann, Wurtz, Helmholtz, and Mendeléeff are those who have passed away leaving imperishable memories behind them. Lord Rayleigh, Professor Ostwald, and Professor Emil Fischer, we rejoice to think, still remain great captains of science militant here upon earth. To this distinguished line of Faraday lecturers the Chemical Society has now added another member in the person of Professor Richards, of Harvard, the eminent savant whom we are to have the pleasure and privilege of hearing to-night. Professor Richards requires no introduction from me; his work, his important contributions to science, especially his determination of atomic weights and his experiments on the compressibility of the elements, are not only

well known in this country, but throughout the chemical world. I have great pleasure in calling upon Professor Richards to deliver the Faraday lecture.

Professor Richards then delivered the Faraday Lecture, of which the following account is an abstract: *

The fundamental properties of the elements.

The subject of my lecture to-night concerns the methods and general results of several extended series of investigations, planned with the hope of adding a little to the foundations of human knowledge by means of careful experiment.

Among all quantities worthy of exact measurement, the properties of the chemical elements are surely some of the most fundamental, because the elements are the vehicles of all the manifold phenomena within the range of our perception.

Weight is clearly one of the most significant of these properties. In the exact determination of atomic weights each portion of substance to be weighed must be free from the suspicion of containing unheeded impurities; otherwise its weight will mean little. Every substance must be assumed to be impure, every reaction must be assumed to be incomplete, every measurement must be assumed to contain error, until proof to the contrary can be obtained.

That the atomic weights may be connected by precise mathematical equations seems highly probable; but although many interesting attempts have been made to solve the problem, the exact nature of such relationships has not yet been discovered. It seems to me that the discovery of the ultimate generalisation is not likely to occur until many atomic weights have been determined with the utmost accuracy.

Volume also is important. About twelve years ago, on applying van der Waals' well-known equation to several gases, it seemed clear to me that the quantity b is not really a constant quantity, but is subject to change under the influence of both temperature and pressure. But if the quantity b (supposed to be dependent upon the space actually occupied by the molecules) is changeable, are not the molecules themselves compressible? If changes in the bulk of molecules are to be inferred even from gases, may not the expansion and contraction of solids and liquids afford a much better clue to the relative expansion and contraction of these molecules? Much evidence has been accumulated pointing toward a positive answer to these questions.

* Full Report, *Trans.*, 1911, p. 1201.

The ordinary conception of a solid has always seemed to me little short of an absurdity. A gas may very properly be imagined with moving particles far apart, but what could give the rigidity of steel to such an unstable structure? The most reasonable conclusion, from all the evidence taken together, seems to be that the interstices between atoms in solids and liquids must usually be small, even in proportion to the size of the atoms themselves, if, indeed, there are any interstices at all. The kinetic theory of *gases* remains unmolested by these considerations, except as they indicate the changeability of b in the equation of van der Waals, but the new views affect seriously the application of this equation to solids and liquids.

The compressibilities of thirty-five elements and many simple compounds were studied with sufficient care to leave no doubt as to their relative values. It became at once manifest that the formation of a compound of a compressible element was attended with greater decrease of volume than the formation of a similar compound of a less compressible element, other things being equal. This is just what the theory leads us to expect, and is a fact inexplicable by any other hypothesis as yet known to me.

Another essential aspect of the theory of compressible atoms is that which concerns cohesion. If the pressure of chemical affinity causes atomic compression, may not the pressure of cohesive affinity also have the same effect? The affinity which prevents solids and liquids from vaporising is generally admitted to produce great internal pressure; must it not tend to compress the molecules into smaller space? Molecules with high cohesive affinity (those of substances hard to volatilise) should be much compressed, and possess small volume, whereas molecules with a slight cohesive affinity should be more bulky. Moreover, those molecules already much compressed by their own self-affinity would naturally be but little affected by additional pressure.

Thus, as regards two substances otherwise similar, the less volatile one would be less compressible, denser, and possess greater surface tension. These outcomes of the theory correspond with the facts in a majority of cases thus far studied. Differences of structure and differences of chemical nature sometimes conceal these relations; the parallelism appears most strikingly among isomeric compounds. In brief, the bulk of evidence strongly indicates that cohesiveness, as well as chemical affinity, exerts pressure in its action, and hence that each plays a part in determining the volumes occupied by molecules.

Carried through to its logical conclusion, the idea that atoms are compressible gives one quite a new conception of the molecular

mechanics of the universe. The influence of atomic compressibilities may be perceived everywhere, and in most cases each fact seems to fit easily and without constraint into its place in the hypothesis. Even apparent exceptions, such as the abnormal bulk of ice, may be ascribed in a reasonable fashion to superimposed effects.

The more closely the actual data are studied, the more plausible the hypothesis of compressible atoms appears. Ten years' experience with its interpretations leads me to feel that the idea is highly suggestive and helpful in stimulating new search after truth and in correlating and codifying diverse facts. By such fruits are hypotheses justified.

Chemical energetics being involved in the consideration of these relations, I sought to improve the technique of thermochemistry. The new method of adiabatic calorimetry was devised, and with it interesting results have been obtained.

All these and other properties of the elements are to be compared with each other quantitatively. New evidence is at hand showing that they do not all vary with the same periodicity as the atomic weights increase. The solution of the cosmic riddle is of the greatest importance to humanity, because only through a complete understanding of his own structure and that of his environment can man obtain control of the necessary conditions of his existence. The outlook is full of hope for the future.

In presenting the Faraday Medal to Professor Richards at the conclusion of the lecture, the PRESIDENT said: Professor Richards,—It is now my pleasant duty, in the name of the Chemical Society, to present you with the Faraday Medal, which bears the effigy of the Master, and which has been struck expressly for this occasion. It is the highest honour which this Society has to confer. In making this presentation I desire to assure you of the sincere appreciation and the deep regard which your colleagues in this country have for your work, and also of the great and enduring importance which we attribute to your scientific discoveries.

Professor ODLING, in proposing a vote of thanks to the lecturer, said: Mr. President, Ladies and Gentlemen,—Some two or three days ago I was highly gratified by being invited to be present by the President, the distinguished son of a distinguished father, to undertake the duty of proposing a vote of thanks to the lecturer. But this gratification, I find now, is sadly marred by the sense of my utter incompetence to express in fitting terms our appreciation for the intellectual treat which has been put before us. At the same time there is, perhaps, a certain inferior fitness in this duty being assigned to me in consideration of my connexion with

Professor Faraday, as being for a time his successor in this institution, and with the Chemical Society, by which the lectureship has been instituted. At the present time the Fullerian professorship is occupied by Sir James Dewar, who is unfortunately not able to be present with us on this occasion, and whose personal exertions have added so much to the reputation of this professorship. In the time between his acceptance of the professorship and his assumption of office, the professorship was held by myself and by Dr. Gladstone, and this particularly, therefore, brings us into association with the Royal Institution. With regard to the Chemical Society I am perhaps entitled to speak on its behalf in a double capacity, in that I am at the present time the senior Fellow of the Society, and that the institution of this lectureship was carried out at my personal proposition, and, in some measure, I venture to say, through my personal activity, because, although the proposition met with hearty goodwill, there were some technical difficulties which required to be smoothed over. As the oldest member of the Chemical Society, I may venture to remind you that I was elected in the presidency of Professor Brande, a long time the secretary of the Royal Society and the favourite pupil of Sir Humphry Davy, and the successor of Sir Humphry Davy in his professorship of the Royal Institution, he himself being subsequently succeeded by Faraday. On the institution of this lectureship we were fortunate in securing Dumas as our first lecturer. It was thereby at once recognised that a very high standard of proficiency had been established for the lecturers who would follow him. That standard has been thoroughly well kept up by Professor Richards, to whose admirable and searching address we have listened with so much interest. For myself I would venture to say that I do not feel at all shocked by his proposition as to the absolute continuity of matter in the solid and liquid states. On the occasion of the first Faraday lecture, Dumas enlarged on the absolute unresolvability of what we called the chemical elements, as they were then known. He pointed out that those forms of matter had existed unchanged for millions of years, and suggested that they were likely to remain unchanged for millions of years to come, a suggestion which I would recommend with all deference to Sir William Ramsay. Our present lecturer, Professor Richards, has, we shall all agree, more than attained the high standard which was originally set up. I had the pleasure of hearing Professor Richards at Oxford a few days ago, and I was much struck by his expression of hopefulness for the future, that there should be no resting places in chemistry, and that the work should go on for ever. If we look back to the time of the institution of the Chemical

Society, some seventy years ago, I think we may say there has been no decade in which fundamental points of importance in the way of discovery and interpretation have been lacking, and neither has continuity failed. On the occasion to which I have referred, Professor Richards enlarged on the fact that, so far from having passed the grand age of chemistry, we were really after all only at the beginning. That is the feeling which must animate all of us. When the Faraday Lectureship was instituted, it was with the two-fold object of doing honour to Faraday, and of enabling the Fellows of the Chemical Society to meet and hear the views of the most eminent men among foreign professors. That Professor Richards possesses the qualification of eminence goes without saying, but that he possesses the qualifications of being a foreigner may be very much doubted. Here we do not recognise the citizens of the United States, and more particularly the scientific men of the United States, with many of whom it has been my advantage to be associated, as being in any way foreigners. We are pleased to greet them, and Professor Richards is one of ourselves. At the present moment we have the professors of chemistry at Harvard and Yale on our list of Honorary Fellows, and a number of other illustrious citizens of the United States whom we are proud to consider as being part and parcel of ourselves.

Sir WILLIAM TILDEN: Mr. President, Ladies, and Gentlemen,—I rise very willingly to second the resolution which has been laid before the meeting by our senior Fellow. But, as might be expected when you think that Dr. Odling was asked to move the resolution, you will see that he has exhausted the subject. However, I, too, have enjoyed the privilege of being present on a good many occasions when the Faraday Lectures have been given in this room, and, though, of course, I was very young at the time, I quite distinctly remember the magnificent discourse given by Dumas. I remember also that, in his peroration, he seemed to indicate that there was some sort of limit set, either by human capacity or in some other way, to the possibilities of science, but if he had lived, as we have had the advantage of doing, down to the beginning of the twentieth century, he would no doubt have changed that opinion fundamentally. However, Professor Dumas was, at the time of the Faraday lecture in 1869, almost at the end of his career, and he did not live many years after that. Our Faraday Lecturer to-night has led us to look forward with a hopeful feeling to the development of new ideas in chemistry and physics. He is still a young man, and, as we hope, not half-way through his magnificent career. In seconding the vote of thanks, I should be glad to be allowed to express in your name our most

cordial wishes for the continuance of his good health, good spirits, and strength, to carry on those laborious experiments with which we are all familiar on this side of the Atlantic. In listening to his discourse, it was with a feeling of mingled relief and disappointment that I found he was talking about the fundamental properties of the elements without having given us the definition of an element. I gathered with some satisfaction that he was really referring to the old-fashioned elements which were talked of by Dalton and others, and which are referred to in the well-known classification of the elements in the periodic table. For my part, I am afraid I am too old to learn the new sort of chemistry which seems to be coming up, but I do feel very strongly that we are not likely to part with our old friends the Daltonian elements —whether they are preserved or not I do not care—so long as the wonderful development of stereochemistry in the last few years continues to be evolved. It seems to me that the whole of stereochemistry is the fundamental argument in favour of the stability of atoms in chemical combination. However, this is not the time, nor am I the person, to present these views to you. I should like to be allowed to support the proposal which has been laid before you so eloquently and in so interesting a manner by Dr. Odling, that we should return to our cousin from the other side of the Atlantic our most cordial thanks for the brilliant and admirable discourse which he has given us to-night.

Professor DIXON: Mr. President, Ladies, and Gentlemen,—On looking back at my late tenure of the office of President, which you, Sir, I think, have defined as two years' hard labour, I know there is one pleasurable duty which more than made amends for all the routine duties which fell to my lot in that position, and that was the privilege of conveying the invitation of this Society to the Faraday Lecturer of to-night. The Chemical Society looks high, and it expects much. Professor Richards has more than fulfilled those expectations. We have listened to-night to a story that is more entrancing than any fairy tale, because as we followed the flight of the lecturer's imagination we knew that that flight was surely guided and controlled by a man who had measured and weighed the elements with an accuracy hitherto unknown. Concerning the weighing of the elements, our old European ideas of finality have been overthrown by Professor Richards and his school, and we are at this moment seeing the fulfilment of the prophecy of Canning when he said, "I look to the new world to redress the balance of the old."

The CHAIRMAN having put the vote to the meeting, it was carried with acclamation.

Professor RICHARDS: Mr. President, Ladies, and Gentlemen,—I can hardly find words to express my very deep and heartfelt appreciation, first, of the great honour, the extraordinarily high honour, which the Chemical Society has conferred upon me by inviting me to give this lecture and by awarding me this famous Medal, and, secondly, by the most kind expressions of opinion and of good feeling which I have heard here to-night. I shall treasure this Medal always, as a token of your kindness, and I shall, whenever I look at it, think of this memorable evening in this memorable building, where not only the great Faraday, but so many great men, have laboured and lectured.

Thursday, June 15th, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. William Gidley Emmett, J. T. M. Dunlop, and A. W. Titherley were formally admitted Fellows of the Society.

The PRESIDENT stated that the Council, at their meeting held that afternoon, had sealed an Address of Congratulation to His Majesty King George V. on the occasion of his Coronation, and an Address of Congratulation to the University of St. Andrews on the Celebration of the Five Hundredth Anniversary of the Foundation of that University.

TO HIS MOST GRACIOUS MAJESTY KING GEORGE V.

May it please Your Majesty,

We, the President, Council, and Fellows of the Chemical Society beg leave to offer to your Majesty our sincere and most respectful congratulations on the auspicious event of your Coronation.

We approach you with the more confidence when we remember how much the science of Chemistry and the position of our Society are indebted to the favours of your august House. We ever bear in mind that a Royal Charter was granted to the Chemical Society by Queen Victoria, and that the Royal College of Chemistry, which was so largely instrumental in fostering and developing the study of our science in this country, was founded by your illustrious Grandfather, the late Prince Consort. It is, moreover, with special gratitude that we recall the lively interest which, as recently as

two years ago, was taken by your Majesty and Her Majesty Queen Mary in the International Congress of Applied Chemistry, when you extended the Royal welcome to the chemists of all nations assembled in the Capital.

We venture to hope that not only chemical research, but the pursuit of all useful knowledge, may be promoted and furthered in this realm under your benevolent and gracious patronage, and we beg to assure Your Majesty of our loyal devotion as we do earnestly hope and pray that Your Majesty's reign may be long, happy, and fruitful.

Signed on behalf of the Chemical Society,

(*Signed*) PERCY F. FRANKLAND, *President.*
„ ALEXANDER SCOTT, *Treasurer.*
„ ARTHUR W. CROSSLEY } *Honorary*
„ G. T. MORGAN } *Secretaries.*
„ HORACE T. BROWN, *Foreign Secretary.*

Dated this the Fifteenth Day of June, One Thousand Nine Hundred and Eleven.

TO THE UNIVERSITY OF ST. ANDREWS.

On the auspicious event of the Celebration of the Five Hundredth Anniversary of the Foundation of your University, we, on behalf of the Chemical Society, desire to offer you our most sincere and hearty congratulations.

We share the world-wide interest which is evoked by the oldest and most picturesque of the Scottish Universities, and we rejoice to think that this ancient seat of knowledge should have so early recognised the claims of natural science as to establish a Chair of Chemistry already one hundred years ago.

We congratulate you on your not having allowed the venerable traditions of the past to overshadow the urgent needs of the present, and we cordially admire the munificent and devoted generosity of your friends in raising the worthy buildings, equipped on modern lines, for the study of Chemistry.

It is, moreover, with lively satisfaction that we have come to regard your Chemical School as an active and fertile centre of research, in which have been conducted a large number of valuable investigations, the results of which are embodied in the *Transactions* of our Society.

We trust that the now happily accomplished absorption of the Dundee College by the University may prove of great mutual

benefit, and that the blending of the young institution with the old may be a guarantee of continued strength and fertility.

In the name of the Council and Fellows of the Chemical Society we wish you all prosperity in the future, and we would express the earnest hope that the grey Town set by the Northern Sea may never cease to attract and inspire active workers, not only in our own science, but also in other branches of learning.

Signed on behalf of the Chemical Society,

(*Signed*) PERCY F. FRANKLAND, *President.*
„ ALEXANDER SCOTT, *Treasurer.*
„ ARTHUR W. CROSSLEY } *Honorary*
„ G. T. MORGAN } *Secretaries.*
„ HORACE T. BROWN, *Foreign Secretary.*

Dated this the Fifteenth Day of June, One Thousand Nine Hundred and Eleven.

The PRESIDENT announced that the Secretary of State had intimated his intention of making Regulations dealing with the smelting of materials containing lead, the manufacture of red or orange lead, and the manufacture of flaked litharge, in accordance with a draft, copies of which may be obtained on application to the Factory Department, Home Office, London.

Certificates were read for the first time in favour of Messrs.:

Lionel Gowing-Scopes, 3, Estcourt Street, Devizes.
George Wishart, B.A., Royal School, Armagh.

A ballot for the election of Fellows was held, and the following were declared subsequently duly elected:

Ernest Andrew Atkins.
Norman Ernest Atkinson.
Arthur Owen Blackhurst.
George Arthur Bradshaw, M.Sc.
Arthur Frederick Clarke.
Charles Ernest Cooke.
Thomas Cowling.
Ganesh Datta, B.A.
Rudolph Demuth.
Benjamin Gallsworthy.
Edgar Harold Gardner.
Joges Chandra Ghose, M.A.
Cyril Herbert Koszelski Gonville.
Rowland Lewis Goold.
Edward Lionel Joseph.
Henry Edmund Linenbröker.
Herbert James Ling.
Richard William Merriman, M.A.
Felix Gabriel Paul.
Leonard Ison Pitt, B.Sc.
William Keighley Walton.

Of the following papers, those marked * were read:

***174. "The alleged complexity of tellurium."**
By Augustus George Vernon Harcourt and Herbert Brereton Baker.

It has been asserted by Flint (*Amer. J. Sci.*, 1910, [iv], **30**, 209) that tellurium can be separated into two fractions by partial precipitation of the tetrachloride by water.

Using 200 grams of highly purified telluric acid, the authors have repeated the work. After four partial precipitations, Flint obtained a diminution of a whole unit in the atomic weight of tellurium, but the authors find that the atomic weight is not altered. The mean result of five determinations of the atomic weight of the fourth fractionation was 127·54, that of material similarly purified, but without the fractional precipitation, being 127·53. They conclude that no separation is effected by this method, and that it is probable that Flint's material was insufficiently purified.

Discussion.

Prof. Ernst Cohen said that he was extremely interested in the facts communicated by Dr. Baker, as they cleared up several doubtful points in some researches on the allotropy of tellurium which had been carried out during the last two years in his (the speaker's) laboratory.

It had been known for a long time that allotropic forms of tellurium existed, but we had been entirely ignorant of the relations between them and of the conditions under which they could be formed. The measurements of Exner, Berthelot, Beljankin, and others in this direction did not agree with each other, but an explanation of this disagreement was found in the fact that the allotropic change of one of these forms was markedly affected by light, which displaced the equilibrium.

Flint's recent statements introduced difficulties which the authors had now removed, as they had shown that tellurium must still be regarded as a single elementary substance. It was thus possible to bring all these phenomena, which appeared so mysterious, under the head of dynamical allotropy.

***175. "The purification and properties of acetic acid."**
By William Robert Bousfield and Thomas Martin Lowry.

Acetic acid may be purified by distilling from potassium permanganate, using a still-head to retain acids of higher boiling point, and then freezing to remove the water. The purified acid melts at 16·60°, and has a density of 1·05148 at 18°/4°, and 1·04922 at 20°/4°; its maximum conductivity when mixed with water is $\kappa_{18}=0{\cdot}001641_5$.

Discussion.

Dr. Veley remarked that those workers who had been engaged in the purification of even the commonest acids could fully appreciate the difficulties encountered in preparing acetic acid free from its homologues, so as to obtain trustworthy data for its physical constants, such as electrical conductivity, melting point, and density.

The method adopted for destroying the formic acid by oxidation with potassium permanganate appeared to be of especial interest, as doubts had been expressed as to the statements contained in text-books that formic acid can be completely oxidised under these conditions.

Dr. Wade said that in purifying acetic acid for the preparation of esters he had succeeded in eliminating propionic acid and its immediate homologues by fractional distillation with a small quantity of water, with which it was perhaps not generally known that all the lower fatty acids, with the exception of acetic acid, formed volatile azeotropic mixtures. He employed, however, an evaporator still-head, which, as Young had shown (*Trans.*, 1899, **75**, 699), was much more efficient than the pear column employed by the authors. He doubted whether the oxidisable impurity observed by the authors was formic acid; it was well known that other oxidisable impurities were often present in commercial acetic acid.

Dr. L. F. Guttmann stated that in the course of some experimental work on mixtures of acetic acid and acetic anhydride he had had occasion to prepare pure acetic acid.

On attempting to do so by freezing a large quantity of "purest" glacial acetic acid, allowing it to thaw partially, discarding the liquid portions, and repeating this procedure five or six times, he had expected to obtain a glacial acetic acid of a high degree of purity: the analysis of this acid, however, gave over 100 per cent.

The normal solutions used were most carefully standardised, yet the result remained the same. Pure acetic acid, giving a value of 100 per cent., was subsequently obtained by fractional distillation of the products; it therefore appeared as if pure commercial acetic acid might contain some acetic anhydride which could not be removed by fractional crystallisation.

He wished to know whether the authors had had similar experiences.

Dr. Titherley pointed out that the reducing substance supposed to be formic acid might be glyoxylic acid, which was a common impurity in acetic acid, and which would probably pass over in the earlier fractions on distillation. As glyoxylic acid in small quantities would account for the observations of the authors, he

asked if any attempts had been made to prove the presence or absence of this substance.

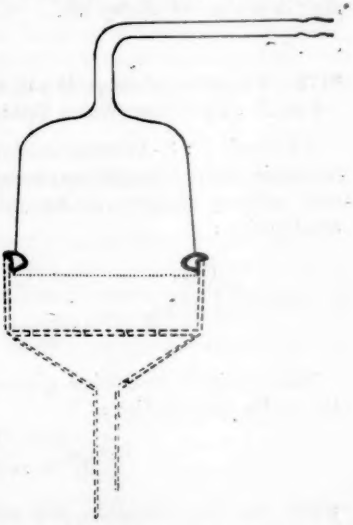
Dr. LOWRY, in reply, said that the acetic acid was distilled in presence of a little water, but the quantity was not sufficient to carry over the higher homologues before the acetic acid as a minimum boiling mixture.

The permanganate method of purification had the advantage that there was no real risk of producing any acetic anhydride; the acid was distilled while still moist, and was subsequently dried by freezing.

The oxidisable impurity of low boiling point might contain glyoxylic acid, but the object was to get rid of it, and not to identify or isolate it.

***176. "The solubility of carbon dioxide in beer." By Alexander Findlay and Bucchok Shen.**

Previous experiments on the absorption of carbon dioxide by beer (Langer and Schultze, *Zeitsch. für das ges. Brauwesen*, 1879, **2**, 369) have been interpreted as showing that beer dissolves more carbon dioxide than the corresponding water-alcohol solution; and the supposed increase has been attributed to adsorption by the colloids present in beer (Emslander and Freundlich, *Zeitsch. physikal. Chem.*, 1904, **49**, 317). These conclusions, however, are not in harmony with experiments carried out by Findlay and Creighton (*Trans.*, 1910, **97**, 536), and the authors now show that carbon dioxide is, as a matter of fact, less soluble in beer than in the corresponding water-alcohol solution, and that the contrary conclusion reached by Langer and Schultze must be attributed to their having used beer supersaturated with carbon dioxide.



***177. "An addition to the Buchner funnel." By Alfred Charles Glyn Egerton.**

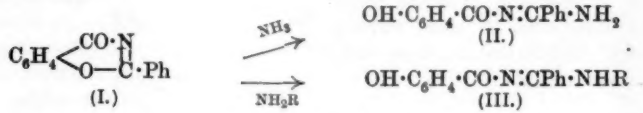
The apparatus consists simply of a small glass hood, which can be connected to a drying tube. The glass hood is made of such a diameter that

it fits inside a Buchner funnel, the joint being made air-tight with a rubber ring situated in a groove round the rim of the hood. It is well to employ a gentle pressure with the ring of a retort-stand to hold the hood in position, unless working with air under diminished pressure. A precipitate collected in the usual manner on the funnel can be dried by means of this simple additional apparatus in a very short time. Besides dispensing with the trouble of transferring the precipitate to a desiccator, the apparatus saves much time in the drying. The drying is most rapid when a steady, not too rapid, stream of air is drawn through the apparatus by means of the filter-pump after passing through a large drying tower filled with calcium chloride; further, the hood, which is made of blown glass or, for very rapid drying, of metal, can be warmed with a flame. The precipitate can, if desired, be dried under diminished pressure by affixing a screw clip to the air inlet of the drying tower. Another application of the apparatus is the drying of a precipitate in a non-reactive atmosphere; the gas can be circulated round and round, if necessary, by means of a blowing arrangement fitted to the filter-pump.

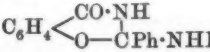
This small, inexpensive apparatus changes a Buchner funnel into an exceptionally efficient desiccator, which dries, not only precipitates collected on the funnel by the usual methods employed therewith, but also can be used conveniently for drying crucibles, etc., in a current of dry air.

***178. "The action of ammonia and amines on 2-phenyl-1:3-benzoxazine-4-one." By Arthur Walsh Titherley and Ernest Chislett Hughes.**

2-Phenyl-1 : 3-benzoxazine-4-one (I) readily combines with ammonia, giving bright orange needles of salicylbenzamidine (II), and primary amines, giving yellow derivatives (III) of similar constitution:



These amidine derivatives give colourless hydrochlorides possessing the cyclic constitution:

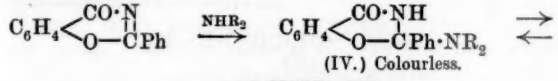


which are very unstable, and readily lose ammonia or an amine,

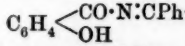
passing through the cyclic compound I into *N*-benzoylsalicylamide in presence of water. The free cyclic bases, which are intermediate compounds in the synthesis of the amidines II and III, are too unstable to exist in the free state.

Salicylbenzamidine (II) may also be synthesised from phenyl salicylate and benzamidine, and *o*-hydroxytriphenylcyanidine also results as a secondary product.

2-Phenyl-1 : 3-benzoxazine-4-one combines with secondary amines, giving mixtures of labile isomeric cyclic and open-chain compounds of the type IV and V:



(IV.) Colourless.

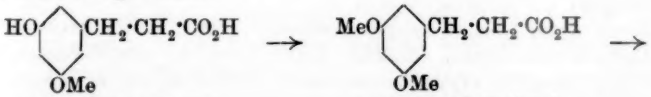


(V.) Yellow.

With dimethylamine no proper separation could be effected, but with diethylamine the colourless compound (IV) was isolated. With diphenylamine a bright yellow compound (V) was obtained, which, owing to steric influences, does not possess normal phenolic properties. It is probable that in all the yellow open-chain derivatives the molecule is bordering on ring-formation, and the colour is attributed to the disturbance of residual affinity thus created. Replacement of the hydrogen atom of the phenolic hydroxyl group by methyl in salicylbenzamidine leads to a colourless compound, the velocity of hydrolysis of which is normal as compared with similar amidines, whilst that of salicylbenzamidine and its derivatives is abnormally high owing to ring-formation.

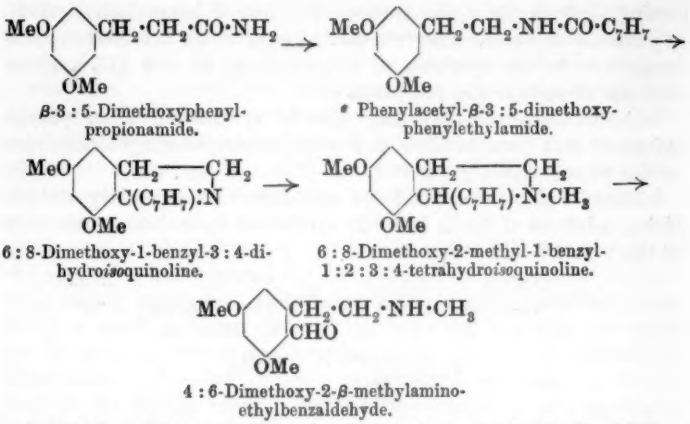
*179. "**Synthesis of 4 : 6-dimethoxy-2-β-methylaminoethylbenzaldehyde.**" **By Arthur Henry Salway.**

4 : 6-Dimethoxy-2-β-methylaminoethylbenzaldehyde has been synthesised from β-5-hydroxy-3-methoxyphenylethylamine (*Trans.*, 1910, **97**, 2413) according to a series of reactions similar to those employed by the author in the synthesis of cotarnine (*Trans.*, 1910, **97**, 1208). The stages involved in this process are represented by the following scheme:



β-5-Hydroxy-3-methoxyphenylpropionic acid.

β-3 : 5-Dimethoxyphenylpropionic acid.



β-3 : 5-Dimethoxyphenyl-propionamide.

Phenylacetyl-β-3 : 5-dimethoxy-phenylethylamide.

6 : 8-Dimethoxy-1-benzyl-3 : 4-dihydroisoquinoline.

6 : 8-Dimethoxy-2-methyl-1-benzyl-1 : 2 : 3 : 4-tetrahydroisoquinoline.

4 : 6-Dimethoxy-2-β-methylamino-ethylbenzaldehyde.

4 : 6-Dimethoxy-2-β-methylaminoethylbenzaldehyde closely resembles cotarnine in its physiological action on the isolated uterus. On the other hand, it is considerably less toxic than the latter compound.

DISCUSSION.

Dr. TITHERLEY inquired whether the author had instituted any experiments to determine which of the alternative tautomeric (open-chain or cyclic) formulæ represented the constitution of cotarnine and allied derivatives.

180. "Cupriglycollates." By Spencer Umfreville Pickering.

That the cupri-compounds formed by the action of alkalis on copper salts contain their copper in the form of CuO or CuOH, and not as metal displacing hydrogen atoms, has been shown by determinations of the molecular weights of six such compounds (*Trans.*, 1911, **99**, 169): more conclusive evidence has now been obtained by finding that in potassium cupriglycollate the ratio of Cu : K is 1 : 1, in accordance with the formula $CH_2O(CuOH)\cdot CO_2K$, and not 1 : 2, as it would have to be if the metal displaced hydrogen: $(CH_2O)_2Cu(CO_2K)_2$.

From a solution of copper glycollate mixed with excess of potassium hydroxide, alcohol precipitates a mauve-coloured, strongly alkaline, crystalline substance, which agrees in composition and properties with the γ-cupri-salts (containing the cuprite group) suggested as existing in such solutions. The corresponding salts of sodium and rubidium (probably, also, of barium) have

been obtained, but not those of lithium, cæsium, or calcium. On heating, they seem, in some cases, to be transformed into compounds in which an atom of copper displaces two atoms of hydrogen in alcoholic hydroxyl groups.

181. "Polymorphic phthalylhydrazides." By Frederick Daniel Chattaway and Donald Frederick Sandys Wünsch.

Some years ago it was observed that phthalylphenylhydrazide, when crystallised from any ordinary solvent, separates almost invariably in two modifications different both in crystalline form and in colour. Each modification could be obtained free from the other by altering the temperature at which crystallisation took place. While this work was in progress, Dunlap (*J. Amer. Chem. Soc.*, 1905, **27**, 1091) published an account of similar observations, and it was consequently discontinued.

The authors have recently again investigated the subject to ascertain if this property of crystallising in two forms is common to all phthalylhydrazides. So far, only one other instance has been found among the simple phthalyl derivatives studied, but it seems certain that this is due to the exact conditions necessary for the appearance of the second modification not having been realised, many other observations on related compounds, which will be communicated later, leading to the conclusion that it should be possible to obtain every phthalyl and substituted phthalyl hydrazide in two forms.

A large number of phthalylhydrazides were described. These compounds are very easily obtained by heating together phthalic anhydride and the corresponding hydrazine; the reaction which occurs may be formulated thus:

$$\begin{matrix} CO\cdot O \\ | \\ C_6H_4 \end{matrix}\!\!>\!CO + H_2N\cdot NHR = \begin{matrix} CO\cdot O \\ | \\ C_6H_4 \end{matrix}\!\!>\!C{:}N\cdot NHR + H_2O.$$

The crystals separating at the higher temperature are bright yellow or orange, those into which they pass when the temperature is lowered being almost colourless.

In every case where only one modification has been observed, it is the one having the deep orange colour.

182. "Decomposition of hydrazides and hydrazones by heat." By Frederick Daniel Chattaway, Charles Linaeus Cumming, and Bernard Howell Wilsdon.

In continuation of an investigation into the action of heat on hydrazines, the reactions which take place when various hydrazides and hydrazones are heated have been studied.

When the phthalylhydrazides are heated, vigorous reaction, accompanied by the evolution of heat, sets in at a definite temperature, nitrogen and ammonia are liberated, and a phthalanil is produced; for example:

$$3\begin{matrix}CO\cdot O\\ C_6H_4\end{matrix}\!>C{:}N\cdot NH\cdot C_6H_5 = 3\begin{matrix}CO\cdot O\\ C_6H_4\end{matrix}\!>C{:}N\cdot C_6H_5 + N_2 + NH_3.$$

In the case of hydrazones two main reactions take place, resulting in the formation of an unsaturated hydrocarbon, nitrogen, and a saturated hydrocarbon; thus, for example:

$$2C_6H_5\cdot CH{:}N\cdot NH\cdot C_6H_5 = C_6H_5\cdot CH{:}CH\cdot C_6H_5 + N_2 + 2C_6H_6,$$

or in the formation of an aldehyde-anilide, nitrogen, and ammonia, thus:

$$3C_6H_5\cdot CH{:}N\cdot NH\cdot C_6H_5 = 3C_6H_5\cdot CH{:}N\cdot C_6H_5 + N_2 + NH_3,$$

a somewhat larger amount of the hydrazone, as a rule, undergoing the latter decomposition. It seems highly probable that the so-called β-phthalylphenylhydrazide, melting at 210°, is really impure phthalanil produced from the ordinary or α-phthalylphenylhydrazide by the above-described decomposition.

183. "Some reactions of gum kino." By John Lionel Simonsen.

The author described some experiments on the constituents of the gum of *Pterocarpus Marsupium*.

184. "Electromotive forces in alcohol. Part I. Concentration cells with electrodes reversible to chlorine ions." By Arthur Lapworth and James Riddick Partington.

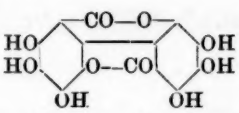
Fairly satisfactory results may be obtained with such cells, containing alcoholic hydrogen chloride, with electrodes of silver or mercury, and with silver chloride and mercurous chloride, respectively, as depolarisers.

The transport number of chloridion is found to be about 0·37, as contrasted with 0·16 in aqueous hydrochloric acid. It was shown that this is due to the hydrogen ion, as the transport numbers for the ions of most salts hitherto examined do not appear to be greatly affected by such a change of solvent.

185. "Some oxidation products of the hydroxybenzoic acids. Part III." By Arthur George Perkin.

The substance $C_{14}H_6O_{10}$, now termed *caeruleoellagic acid*, previously obtained by heating ellagic or flavellagic acid with sulphuric acid (*Proc.*, 1906, **22**, 114), can also be prepared by the action of

arsenic acid on the sulphuric acid solutions of these compounds. The *acetyl* derivative $C_{14}O_{10}(C_2H_3O)_6$ melts at 330—332°, and is in reality colourless, and the *benzoyl* compound $C_{14}O_{10}(C_7H_5O)_6$ forms needles melting at 343—345°. By distillation with zinc dust, caeruleocellagic acid gives fluorene, and with boiling potassium hydroxide solution a substance $C_{12}H_{10}O_8$, which crystallises in prismatic needles, and is evidently an *octahydroxydiphenyl*, the *acetyl* derivative of which, $C_{12}H_2O_8(C_2H_3O)_8$, forms colourless needles, melting at 177—178°. Caeruleocellagic acid, to which the constitution:



is assigned, dyes mordanted fabrics similarly to flavellagic acid, but somewhat more strongly.

186. "The triazo-group. Part XIX. Nitrosoazides of dipentene, *d*-limonene, and *l*-limonene." By Martin Onslow Forster and Frederik Marinus van Gelderen.

Dipentene nitrosoazide, $C_{10}H_{15}(:NOH)\cdot N_3$, prepared from either the nitrosochloride or the nitrosate by the action of sodium azide in aqueous alcohol, crystallises from methyl alcohol in colourless plates, melting at 72—73°; alcoholic potash eliminates hydrazoic acid, producing *i*-carvoxime. i-*Triazodihydrocarvone*, $C_{10}H_{15}ON_3$, arising from the foregoing nitrosazide (its oxime) by the action of hot aqueous oxalic acid, is a colourless liquid, having a pleasant odour of peppermint; it boils at 81°/0·4 mm., and has D 1·0409/20°. The *semicarbazone* melts at 132—133°.

d-*Limonene nitrosoazide*, $C_{10}H_{15}(:NOH)\cdot N_3$, whether prepared from the α- or the β-nitrosochloride, melts at 52—53°, has $[\alpha]_D$ 6·5°, and is converted into *l*-carvoxime by the action of alcoholic potash. d-*Triazodihydrocarvone*, $C_{10}H_{15}ON_3$, produced when the nitrosoazide is heated with aqueous oxalic acid, boils at 93°/0·46 mm., has D 1·0487/20°, and $[\alpha]_D$ 88·49°; the *semicarbazone* melts at 220°.

l-*Limonene nitrosoazide*, $C_{10}H_{15}(:NOH)\cdot N_3$, melting at 52—53°, and having $[\alpha]_D$ −3°, gives *d*-carvoxime with alcoholic potash. l-*Triazodihydrocarvone*, $C_{10}H_{15}ON_3$, obtained by hydrolysis with oxalic acid, boils at 93—94°/0·48 mm., has D 1·0472/20°, and $[\alpha]_D$ −92·5°; the *semicarbazone* melts at 220°.

187. "The relation of the velocity of chlorination of aromatic compounds to constitution. Part I. Chlorination of anilides." By Kennedy Joseph Previté Orton and Harold King.

The speed of chlorination (formation of monochloro-derivatives) of a number of acylanilides has been measured in glacial acetic acid solution. It was shown that the rate of the reaction varies enormously with the character of the substituent in the benzene nucleus. The nature of the acyl groups has a comparatively subsidiary effect.

Naphthalides are chlorinated at a far greater rate than the anilides.

188. "Chlorination of acylanilides. Effect of the constitution of the acyl group on the proportion of the ortho- and para-derivatives." By Harold King and Kennedy Joseph Previté Orton.

The proportion of *o*- and *p*-chloro-derivatives produced in the chlorination of form-, propion-, stear-, and benz-anilide has been estimated. Comparison with acetanilide (Jones and Orton, *Trans.*, 1909, **95**, 1056) shows that the largest proportion of the *o*-chloro-derivative is formed in this case. Acetanilide yields 45, propion-anilide 26, stearanilide 12, benzanilide 11, and formanilide 3 per cent. of the *o*-chloro-derivative.

189. "The influence of the alternating factor in certain series on the molecular volumes at the melting point." By Gervaise Le Bas.

An examination of the molecular volumes of the paraffins at the melting point shows that the volume differences for CH_2 alternate in value exactly as do the melting points in several homologous series.

By finding the number of H equivalents in each compound (since C=4H), that is, W, and dividing this into the volume at the melting point, V, the ratio V/W gives the volume of H in each compound.

The molecular volumes of the normal paraffins at various temperatures can be calculated by means of interpolation formulæ with two constants.

I.—*Table of Constants.*

Compound.	M.W.	*W.*	M.P.	d_T.
Nonane, C_9H_{20}	128	56	−51·0°	0·7330 (0°)
Decane, $C_{10}H_{22}$	142	62	−32·0	0·7454 (0°)
Undecane, $C_{11}H_{24}$.....	156	68	−26·5	0·7557 (0°)
Dodecane, $C_{12}H_{26}$.....	170	74	−12·0	0·7730 (m. p.)
Tridecane, $C_{13}H_{28}$.....	184	80	− 6·2	0·7755 (m. p.)

II.—*Constitutive Effects in the Volumes of Compounds at the Melting Points.*

Compound.	*W.*	*M.V.* m. p.	Δ.	Δ between odd No.'s.	Δ between even No.'s.	*V*/*W* (odd).	*V*/*W* (even).
C_9H_{20}.....	56	165·67				2·957	—
$C_{10}H_{22}$ ...	62	184·54	18·9 16·9	35·7		—	2·976
$C_{11}H_{24}$ ...	68	201·4			35·4	2·962	—
$C_{12}H_{26}$ ...	74	219·9	18·5 17·4	35·9		—	2·972
$C_{13}H_{28}$ ...	80	237·3			35·5	2·966	—
$C_{14}H_{30}$ ...	86	255·4	18·1 17·8	35·9		—	2·970
$C_{15}H_{32}$ ...	92	273·2			35·8	2·970	—
$C_{16}H_{34}$ ...	98	291·2	18·0 17·8	53·8		—	2·971
$C_{17}H_{36}$ ...	104	309·0				2·971	

Study of the data shows that:

(1) The even members of the series show augmented values of *V*/*W*, and the odd members depressed values. This is in accord with the fact that the melting-point curves are different, the one for the odd members falling below that for the even members.

(2) The values of *V*/*W* for the even members diminish to a constant value, 2·970, and those for the odd members increase to the same constant value. Thus, again, there is correspondence between the melting-point and volume curves in that the double curves gradually approach each other as the series is ascended.

The conclusion is drawn that for both the volumes and the melting points the alternating factor always exerts a depressing effect on the compound with an odd number of carbon atoms, and an elevating one on the compound with an even number of carbon atoms. The alternating factor consequently similarly affects both physical properties.

190. **"The elimination of bromine from phenyl *p*-methoxystyryl ketone dibromide." By Forsyth James Wilson and Alfred Archibald Boon.**

The authors find that when phenyl *p*-methoxystyryl ketone dibromide is treated with propyl alcohol, *iso*butyl alcohol, benzyl

alcohol, or acetic acid, one of the products is *phenyl bromo-p-methoxystyryl ketone*, $MeO{\cdot}C_6H_4{\cdot}CBr{:}CH{\cdot}COPh$ or $MeO{\cdot}C_6H_4{\cdot}CH{:}CBr{\cdot}COPh$,
which melts at 93—94°.

When the dibromide is heated with *iso*propyl alcohol, *tert.*-butyl alcohol, acetone, or benzoin, the ketone is regenerated.

191. "Some new inorganic salts." By Thomas Vipond Barker.*

In continuation of previous work on the regular growths on each other of isomorphous crystals, the author has completed the investigation of the series of alkaline periodates by the inclusion of the lithium salt, which proves to be entirely different from the compound described (but not analysed) by Rammelsberg, so that it seems probable that his compound was an impure specimen of sodium periodate.

A further contribution to the list of isomorphous substances has been made by the preparation of two new double chromates of the general formula $R_2Mg(CrO_4)_2,6H_2O$, in which R = Rb or Cs; these two salts prove to be strictly isomorphous with the corresponding ammonium salt prepared some sixty years ago by Murmann, and with the better known series of double sulphates.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Trinum Chymicum oder Drey Chymische Tractätlein. I. Fr. Vincentii Koffsky . . . Schöner und ausführlicher Bericht von der ersten Tinctur-Wurzzel des Steins der Weisen, *etc.* (pp. 1—21 only). Strassburg 1699. (*Reference.*) From Dr. A. Harden, F.R.S.

Trinum Chymicum secundum oder Drey Andere Chymische Tractätlein. I. Heinrici Khunrath . . . Philosophische Erklärung von und über dem geheimen äusserlichen sichtbaren Gludt und Flammen-Feur der uhralten Magorum oder Weysen und anderer wahren Philosophen. II. Ein fürtreffliches Judicium und Bericht eines erfahrnen Cabalisten, über die vier Figuren dess grossen Amphitheatri D. Henrici Khunrathi. III. Von der Tinctur Antimonii und Oleo Stibii von Theophrasto Paracelso Auch einem

* This paper was communicated at the Meeting on June 1st.

Anhang zu der Materi dienlichen Sachen Von Basilio Valentino beschrieben. pp. [viii]+174 (misprint for 184). Strasburg 1700. (*Reference.* From Dr. A. Harden, F.R.S.

Valentinus, *Basilius.* His last Will and Testament . . . , wherein he . . . declareth the wayes he wrought to obtain the Philosophers Stone, *etc.* London 1657—56. (9 parts, each having separate title-page. Wanting first title-page, and pp. 21 to 23 of a "Treatise concerning Microcosme.") (*Reference.*) From Dr. A. Harden, F.R.S.

II. *By Purchase.*

Nikaido, *Y.* Beet-sugar making and its chemical control. pp. xii+354. ill. Easton, Pa. 1909. (*Recd.* 14/6/11.)

III. *Pamphlets.*

Pusa Agricultural Research Institute and College. Report 1909–10. pp. 69. Calcutta 1910.

Schrauth, *Walther,* und **Schoeller,** *Walter.* Über die Desinfektionskraft komplexer organischer Quecksilberverbindungen. I. Aromatischer Quecksilbercarbonsäuren. (From the *Zeitsch. Hyg. Infect.*, 1910, **66.**)

Stoddart, *Frederick Wallis.* Nitrification and the absorption theory. An account of the principles of the modern sewage filter. pp. 24. Bristol 1911.

Thunberg, *Torsten.* Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. IV—IX. (From the *Skand. Arch. Physiol.*, 1910, **24.**)

—— Untersuchungen über autoxydable Substanzen und autoxydable Systeme von physiologischem Interesse. I. and II. (From the *Skand. Archiv. Physiol.*, 1910, **24.**)

Widmark, *Erik M. P.* Untersuchungen über die chemischen Bedingungen für das Beibehalten der normalen Struktur der Zellen. I. and II. (From the *Skand. Archiv. Physiol.*, 1910, **23, 24.**)

THE LIBRARY.

The Library will be closed for Stocktaking from **Monday, August 14th,** until **Saturday, August 26th,** 1911, inclusive.

Fellows are particularly requested to return all Library Books in their possession not later than **Wednesday, August 9th.**

LIST OF FELLOWS, 1911.

The List of Fellows for 1911 is now in active preparation, and changes of address received after July 31st cannot be included in it.

In order that the new List may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

R CLAY AND SONS, LTD., BRUNSWICK ST. STAMFORD ST., S.E., AND BUNGAY, SUFFOLK

[*Issued* 30/10/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 390.

The Council has ordered the following letter and report to be printed in the Journal and Proceedings of the Society:

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY,
ROYAL COLLEGE OF SCIENCE,
SOUTH KENSINGTON,
LONDON, S.W.
October 4th, 1911.

GENTLEMEN,

I beg to forward you the Annual Report of the International Committee on Atomic Weights for 1912, to which I have appended, as desired by them, the signatures of Professors Clarke, Ostwald, and Urbain.

Slight changes have been made in the atomic weights of calcium, erbium, iron, mercury, tantalum, and vanadium, which are indicated, in accordance with a suggestion received from Germany, by asterisks.

The only addition to the list of elements is that of niton (radium emanation), with the symbol Nt, and the atomic weight 222·4, as determined by Gray and Ramsay. This is in fair agreement with

the value calculated by Debierne from observations on the rate of flow of the gas.

I have the honour to be, Gentlemen,
Your obedient servant,
T. E. THORPE.

To the Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.

Report of the International Committee on Atomic Weights, 1912.

Since the report of the Committee for 1911 was prepared, a number of important determinations of atomic weight have been published, which may be summarised as follows:

Nitrogen.—Guye and Drouginine (*J. Chim. Phys.*, 1910, **8**, 473), from seven analyses of N_2O_4, find, in mean, N = 14·010.

Sulphur.—Burt and Usher (*Proc. Roy. Soc.*, 1911, *A*, **85**, 82), by analysis of nitrogen sulphide, N_4S_4, have determined the ratios S : N : : 1·0 : 0·43687. Hence, calculating with N = 14·009, S = 32·067, in good agreement with the accepted value.

Chlorine.—Burt and Gray (*Chem. News*, 1911, **103**, 161 and 170) have continued their work upon the density of hydrochloric acid, and confirmed their former determination of Cl = 35·46.

Iodine.—Baxter (*J. Amer. Chem., Soc.*, 1910, **32**, 1591) has re-determined the ratio of iodine to silver with extreme care. Combining his results with the previously-determined ratio of silver to iodine pentoxide, he finds Ag = 107·864 and I = 126·913. The value for silver varies from that found by Richards and Willard, and the discrepancy is as yet unexplained.

Sodium.—Goldbaum (*J. Amer. Chem. Soc.*, 1911, **33**, 35) has made analyses of sodium chloride and bromide by a new electrolytic method. The salts were electrolysed with a mercury anode and a weighed silver cathode, and on the latter the halogen was collected in weighable form. From the chloride, with Cl = 35·458, Goldbaum found Na = 22·997; the bromide, with Br = 79·920, gave Na = 22·998.

Calcium.—Two papers by Richards and Hönigschmid (*J. Amer. Chem. Soc.*, 1910, **32**, 1577; 1911, **33**, 28) on the atomic weight of calcium have appeared. From analyses of calcium bromide, Ca = 40·070, when Ag = 107·88. From analyses of the chloride, Ca = 40·074. The value 40·07 is adopted in the table at the end of this report.

Cadmium.—Perdue and Hulett (*J. Physical Chem.*, 1911, **15**, 155; see also Richards, *J. Amer. Chem. Soc.*, 1911, **33**, 888), from

electrolytic analyses of cadmium sulphate, conclude that the atomic weight of cadmium is near 112·30. This is lower than the accepted value, but as the investigation is being continued with other salts of cadmium, any change in the table should be deferred.

Mercury.—Easley (*J. Amer. Chem. Soc.*, 1910, **32**, 1117) has continued his work on the atomic weight of mercury, varying his methods. New analyses of the chloride give Hg = 200·63, in confirmation of his former determinations. In a private communication he states that analyses of the bromide lead to the same value. The new figure, Hg = 200·6, should be adopted.

Vanadium.—McAdam (*J. Amer. Chem. Soc.*, 1910, **32**, 1603), by reducing sodium vanadate to sodium chloride, by heating in a stream of dry hydrochloric acid, finds V = 50·967, or 51 in round numbers. The latter figure is as probable as any.

Tantalum.—Balke (*J. Amer. Chem. Soc.*, 1910, **32**, 1127), by hydrolysis of tantalum pentachloride, has determined the ratio $2TaCl_5 : Ta_2O_5$. The mean of five concordant determinations gives Ta = 181·52, when Cl = 35·46. The rounded-off value 181·5 should be accepted.

Tellurium.—Flint (*Amer. J. Sci.*, 1910, [iv], **30**, 209) has continued the work reported by Browning and Flint in 1909 on the fractionation of tellurium by hydrolysis of the tetrachloride. With successive fractions the atomic weight steadily decreased. Seven analyses of the basic nitrate representing the tenth fractionation gave values for Te ranging from 124·25 to 124·42. As the work is still in progress, any acceptance of these low figures would be premature.

Iron.—Baxter, Thorvaldson, and Cobb (*J. Amer. Chem. Soc.*, 1911, **33**, 319), from analyses of ferrous bromide, find Fe = 55·838 when Ag = 107·88. In another communication (*ibid.*, p. 337), Baxter and Thorvaldson find Fe = 55·836. The latter figure is the mean of two series, *meteoric* iron being taken as the starting point. The value 55·84 is given in the table.

Uranium.—Oechsner de Coninck (*Compt. rend.*, 1911, **152**, 711 and 1179), by reduction of UO_2Cl_2 and UO_3,H_2O to UO_2 in hydrogen, concludes that U = 238·5. The work is only approximate in character.

Scandium.—Meyer and Winter (*Zeitsch. anorg. Chem.*, 1910, **67**, 398), in a preliminary series of experiments, find values for Sc ranging from 44·86 to 45·37; in mean, 45·12. This is higher than the recognised value, but its adoption would be premature. More details are needed.

Neodymium.—By extended and careful analyses of the chloride, Baxter and Chapin (*Proc. Amer. Acad.*, **46**, 215) have redetermined

the atomic weight of neodymium. From the ratio $NdCl_3:3Ag$, Nd = 144·268. From the ratio $NdCl_3:3AgCl$, Nd = 144·272. A small correction raises the value to 144·275. The rounded-off value 144·3, given in the table, may be properly retained.

Erbium.—Hofmann (*Ber.*, 1910, **43**, 2635), from analyses and syntheses of the sulphate of "neoerbium," finds Er = 167·68. This may be rounded to 167·7.

Argon.—Determinations of the density of argon, by Fischer and Froboese (*Ber.*, 1911, **44**, 92), give a mean value of 19·95. Hence A = 39·90.

Niton.—Gray and Ramsay (*Proc. Roy. Soc.*, 1910, *A*, **84**, 536), with the aid of the microbalance, have determined the density of the gaseous emanation from radium, to which they give the name *niton*. The mean value found gives Nt = 223, but the value 222·4 is preferred (compare also Debierne, *Compt. rend.*, 1910, **150**, 1740). The gas is a member of the argon group, and seems to be entitled to recognition in the table.

The table of atomic weights for 1912 follows. In accordance with a suggestion received from Germany, the changed values are indicated by an asterisk. The changes are few in number, and only in two cases are they large.

F. W. Clarke.
W. Ostwald.
T. E. Thorpe.
G. Urbain.

1912.

International Atomic Weights.

		0=16.
Aluminium	Al	27·1
Antimony	Sb	120·2
Argon	A	39·88
Arsenic	As	74·96
Barium	Ba	137·37
Bismuth	Bi	208·0
Boron	B	11·0
Bromine	Br	79·92
Cadmium	Cd	112·40
Cæsium	Cs	132·81
Calcium*	Ca	40·07
Carbon	C	12·00
Cerium	Ce	140·25
Chlorine	Cl	35·46
Chromium	Cr	52·0
Cobalt	Co	58·97
Columbium	Cb	93·5
Copper	Cu	63·57
Dysprosium	Dy	162·5
Erbium*	Er	167·7
Europium	Eu	152·0
Fluorine	F	19·0
Gadolinium	Gd	157·3
Gallium	Ga	69·9
Germanium	Ge	72·5
Glucinum	Gl	9·1
Gold	Au	197·2
Helium	He	3·99
Hydrogen	H	1·008
Indium	In	114·8
Iodine	I	126·92
Iridium	Ir	193·1
Iron*	Fe	55·84
Krypton	Kr	82·92
Lanthanum	La	139·0
Lead	Pb	207·10
Lithium	Li	6·94
Lutecium	Lu	174·0
Magnesium	Mg	24·32
Manganese	Mn	54·93
Mercury*	Hg	200·6

		0=16.
Molybdenum	Mo	96·0
Neodymium	Nd	144·3
Neon	Ne	20·2
Nickel	Ni	58·68
Niton* (radium emanation)	Nt	222·4
Nitrogen	N	14·01
Osmium	Os	190·9
Oxygen	O	16·00
Palladium	Pd	106·7
Phosphorus	P	31·04
Platinum	Pt	195·2
Potassium	K	39·10
Praseodymium	Pr	140·6
Radium	Ra	226·4
Rhodium	Rh	102·9
Rubidium	Rb	85·45
Ruthenium	Ru	101·7
Samarium	Sa	150·4
Scandium	Sc	44·1
Selenium	Se	79·2
Silicon	Si	28·3
Silver	Ag	107·88
Sodium	Na	23·00
Strontium	Sr	87·63
Sulphur	S	32·07
Tantalum*	Ta	181·5
Tellurium	Te	127·5
Terbium	Tb	159·2
Thallium	Tl	204·0
Thorium	Th	232·4
Thulium	Tm	168·5
Tin	Sn	119·0
Titanium	Ti	48·1
Tungsten	W	184·0
Uranium	U	238·5
Vanadium*	V	51·0
Xenon	Xe	130·2
Ytterbium (Neoytterbium)	Yb	172·0
Yttrium	Yt	89·0
Zinc	Zn	65·37
Zirconium	Zr	90·6

The following are abstracts of papers received during the vacation, and published, or passed for publication, in the *Transactions:*

192. "Indicators of the methyl-red type."
By Hubert Howard and Frank Geo. Pope. (Trans., 1911, 1333.)

Azo-compounds of the methyl-red type were prepared by combining diazotised anthranilic acid with α-naphthylamine, dimethyl-α-naphthylamine, diphenylamine, and phenyl-α-naphthylamine. Contrary to the statement of Tizard (*Trans.*, 1910, **97**, 2485), the potassium salt of methyl-red can be obtained in a crystalline form, and is not deliquescent.

193. "Dihydrocinnamenylcarbimide (β-Phenylethyl *iso*cyanate)."
By Martin Onslow Forster and Hermann Stötter. (Trans., 1911, 1337.)

Dihydrocinnamenylcarbimide, $C_6H_5 \cdot CH_2 \cdot CH_2 \cdot N{:}C{:}O$, and some of its derivatives were studied, and in the course of their examination it was noticed that whilst this *iso*cyanate converts menthol into the corresponding carbamate, cinnamenylcarbimide transforms that alcohol into menthyl carbamate, a change which involves the disappearance of phenylacetylene.

194. "The synthesis of histidine."
By Frank Lee Pyman. (Trans., 1911, 1386.)

A preliminary account of the synthesis of *r*-histidine has already appeared (this vol., p. 92). The synthesis of histidine itself, that is, the naturally-occurring lævo-modification of this base, has now been completed by the resolution of *r*-histidine.

Both the *d*- and *l*-varieties have been obtained in a practically pure state by crystallisation of the hydrogen tartrates.

195. "The action of benzylamine on *s*-dibromosuccinic acid."
By Edward Percy Frankland. (Trans., 1911, 1775.)

When benzylamine reacts with *s*-dibromosuccinic acid in alcoholic solution it gives rise successively to the following compounds: (I) the *dibenzylamine* salt of dibromosuccinic acid, (II) the *monobenzylamine* salt of bromomaleic acid, (III) the *monobenzylamine* salt of *benzylaminobromosuccinic acid*,

$$CO_2H \cdot CH(NH \cdot C_7H_7) \cdot CHBr \cdot CO_2H,$$

and (IV) the *monobenzylamine* salt of *dibenzylaminosuccinic acid*, $CO_2H \cdot CH(NH \cdot C_7H_7) \cdot CH(NH \cdot C_7H_7) \cdot CO_2H$, from which the free

acid can be obtained by dissolving in hydrochloric acid and precipitating with water.

When the reaction is carried out in aqueous solution the products isolated are the *dibenzylamine* salt of dibenzylaminosuccinic acid and the *dibenzylamide* of *i*-tartaric acid. This formation of an amide in aqueous solution is to be accounted for by an intramolecular rearrangement demonstrated by Lutz (*Diss.*, Rostock) in the action of ammonia and other amines on monohalogen succinic acids, whereby amides of malic acid are produced.

196. "**A method of determining carbon and nitrogen in organic compounds.**" **By Edward Percy Frankland.** (Trans., 1911, 1783.)

The Frankland-Armstrong vacuum combustion process (*Journ. Chem. Soc.*, 1868, **21**, 77) can be adapted for the estimation of carbon and nitrogen in organic compounds. The gases (carbon dioxide and nitrogen) evolved during the combustion of a known weight of substance, generally 0·1 gram or less, are collected, and measured over mercury in a graduated vessel; the carbon dioxide is then absorbed with aqueous potassium hydroxide, and the residual nitrogen transferred to a narrower graduated tube and measured over water.

The process can be carried out in less time than is required by the ordinary carbon-hydrogen combustion method, and the figures obtained both for nitrogen and carbon in a variety of organic compounds are in good agreement with theory. The presence of bromine in the molecule, even up to 80 per cent., has not been found to affect the accuracy of the results, hence this method appears to be of especial advantage in connexion with organic substances containing both nitrogen and halogen.

197. "**The synthesis of derivatives of thioxanthone from aromatic disulphides.**" **By Effie Gwendoline Marsden and Samuel Smiles.** (Trans., 1911, 1353.)

The synthesis of thioxanthones may be accomplished by heating di-*o*-thiobenzoic acid or its derivatives with a suitable aromatic compound in presence of concentrated sulphuric acid, the interaction which takes place being summed up as follows:

$$(CO_2H\cdot C_6H_4\cdot S)_2 + H_2SO_4 = 2CO_2H\cdot C_6H_4\cdot S\cdot OH + SO_2.$$

$$C_6H_4\begin{<}\begin{matrix}CO_2H\\S\cdot OH\end{matrix} + C_6H_4R_2 = C_6H_4\begin{<}\begin{matrix}CO\\S\end{matrix}\!\!>C_6H_2R_2 + 2H_2O.$$

The method may be modified by arranging that the carboxyl group is present in the simple aromatic compound instead of in

the disulphide; thus on heating *p*-dithiodimethylaniline with *m*-hydroxybenzoic acid and sulphuric acid, the corresponding thioxanthone is formed.

198. "Trialkylammonium nitrites and nitrites of the bases of the pyridine and quinoline series. Part II." By Pañchānan Neogi. (Trans., 1911, 1598.)

Picolinium nitrite is obtained, together with the nitrate, by concentrating an ice-cold solution in a vacuum desiccator. *Quinolinium nitrite* exists in solution, but not in the solid condition. *Piperidinium nitrite* has been obtained in colourless plates. *Pyridine methonitrite* is a reddish-yellow liquid. *Piperidine methonitrite* crystallises in colourless plates. *Picoline methonitrite* forms red crystals, and *quinoline methonitrite* dark red crystals.

199. "The density of liquid sucrose and of its solutions in water." By Frederik Schwers. (Trans., 1911, 1478.)

By melting sucrose under paraffin the author has succeeded in determining the density of liquid sucrose at temperatures between $-15°$ and $115°$.

The densities of aqueous solutions of sucrose containing 10, 20, 30, 40, 50, 60, and 70 per cent. of sucrose have also been determined.

200. "The condensation of crotonaldehyde." By Ida Smedley. (Trans., 1911, 1627.)

The condensation of crotonaldehyde under the influence of alkaline condensing agents has been studied. By oxidising the condensation product with silver oxide, and subsequently reducing with phosphorus and hydriodic acid, *n*-octoic acid has been identified. The γ-carbon atom of one crotonaldehyde molecule must therefore have reacted with the aldehyde group of a second molecule.

201. "Ionisation in non-aqueous solvents. Part I." By Harry Medforth Dawson and May Sybil Leslie. (Trans., 1911, 1601.

Measurements of the electric conductivity of non-aqueous solutions of alkali metal iodides and the corresponding polyiodides have shown that, in general, the polyiodides are ionised to a greater extent than the simple iodides. In methyl and ethyl acetate solutions the observed conductivity differences are very large, and in the latter solvent the polyiodides of potassium conduct from

twenty-five to fifty times as well as the simple iodide. Evidence has been obtained in favour of the formation of definite polyiodides in such solutions, and the conductivity differences must be ascribed to differences in the degree of ionisation of the dissolved electrolyte. The simple alkali iodides would appear to be abnormally weak electrolytes when dissolved in methyl and ethyl acetates.

202. "**The formation of glyoxalines from acyl derivatives of α-keto-β-anilino-αβ-diphenylethane.**" **By Arthur Ernest Everest and Hamilton McCombie.** (Trans., 1911, 1746.)

Glyoxalines can be prepared from acyl derivatives of α-keto-β-anilino-αβ-diphenylethane by heating these compounds in sealed tubes with aqueous ammonia:

$$\mathrm{COPh{\cdot}CHPh{\cdot}NH{\cdot}COR} \longrightarrow \begin{matrix}\mathrm{CPh{\cdot}NPh}\\ \|\\ \mathrm{CPh}\text{—}\mathrm{N}\end{matrix}\!\!>\!\mathrm{CR}.$$

From the benzoyl, acetyl, and formyl derivatives respectively there have been prepared by this method 1:2:4:5-*tetraphenylglyoxaline*, 1:4:5-*triphenyl-2-methylglyoxaline*, and 1:4:5-*triphenylglyoxaline*. The *hydrochlorides*, *picrates*, and *platinichlorides* of these substances have also been prepared.

In the formation of all these glyoxalines there was obtained, in varying quantities, 2:3:5:6-tetraphenylpyrazine:

$$\begin{matrix}\mathrm{CPh{\cdot}N{\cdot}CPh}\\ \|\quad\quad\|\\ \mathrm{CPh{\cdot}N{\cdot}CPh}\end{matrix}$$

Some curious colour changes of α-keto-β-anilino-αβ-diphenylethane and its acyl derivatives have been noticed in the course of this work. α-Keto-β-anilino-αβ-diphenylethane itself is yellow, and gives a yellow solution in alcohol, but this solution becomes colourless on the addition of a drop of acid. The acyl derivatives, on the other hand, are colourless, and yield colourless solutions, but these solutions become strongly yellow on the addition of a drop of alkali. The probability is that there exist ketonic and enolic modifications of these substances.

203. "**The osmotic pressure and conductivity of aqueous solutions of Congo-red, and on reversible membrane-equilibria.**" **By Frederick George Donnan and Albert Buckley Harris.** (Trans., 1911, 1554.)

Measurements of osmotic pressure and electrical conductivity show that, although aqueous solutions of Congo-red are very considerably ionised, they exhibit an osmotic pressure corresponding

very closely with the value calculated for single undissociated molecules. On dialysis, solutions of Congo-red suffer a gradual "membrane-hydrolysis." Constant values of osmotic pressure can only be obtained in presence of small concentrations of alkali hydroxide. The effect of various concentrations of sodium hydroxide and sodium chloride on the osmotic pressure has been studied. It has been shown experimentally and theoretically that a non-dialysing electrolyte such as Congo-red causes an unequal distribution of sodium chloride on either side of the membrane (in this case, parchment paper).

204. "Triketohydrindene hydrate. Part V. The analogues of uramil and purpuric acid." By Siegfried Ruhemann. (Trans., 1911, 1486.)

Diketohydrindamine, $C_6H_4<\begin{matrix}CO\\CO\end{matrix}>CH\cdot NH_2$, which is formed by the reduction of oximinodiketohydrindene, $C_6H_4<\begin{matrix}CO\\CO\end{matrix}>C\cdot NOH$, by means of stannous chloride (*Trans.*, 1911, **99**, 1306), could not be obtained pure, owing to the ease with which it is oxidised by the oxygen of the air. It was characterised, however, by the condensation products which it yields with aromatic aldehydes. These substances, which may be represented by the general formula

$$C_6H_4<\begin{matrix}CO\\CO\end{matrix}>CH\cdot N{:}CHR,$$

are not very stable, and are readily hydrolysed to the compounds from which they are formed. The blue coloration which is produced on exposure of diketohydrindamine to moist air is due to the formation of the analogue of murexide, which is the *ammonium* salt of *diketohydrindylidenediketohydrindamine*,

$$C_6H_4<\begin{matrix}CO\\C(ONH_4)\end{matrix}>C\cdot N{:}C<\begin{matrix}CO\\CO\end{matrix}>C_6H_4.$$

This can be prepared from hydrindantin under conditions similar to those which served for the production of murexide from alloxantin (Piloty and Finckh, *Annalen*, 1904, **333**, 27). The ketone,

$$C_6H_4<\begin{matrix}CO\\CO\end{matrix}>CH\cdot N{:}C<\begin{matrix}CO\\CO\end{matrix}>C_6H_4,$$

corresponding with this salt was also isolated; it is, however, readily decomposed by mineral acids.

By the action of triketohydrindene hydrate on uramil dissolved in potassium hydroxide, the *potassium* salt of *diketohydrindylideneuramil*,

$$CO<\begin{matrix}NH\text{——}CO\\NH\cdot C(OK)\end{matrix}>C\cdot N{:}C<\begin{matrix}CO\\CO\end{matrix}>C_6H_4,$$

is produced; it dissolves in water to yield reddish-violet solutions, which are decolorised by dilute hydrochloric acid.

It was found that the colour-reaction which the triketone gives with amino-acids is based on the formation of the ammonium salt of diketohydrindylidenediketohydrindamine.

205. "The constitution of the organic ferrocyanides." By Ernald George Justinian Hartley. (Trans., 1911, 1549.)

In order to throw some light on the constitution of the ferrocyanides, the decomposition of tetramethyl ferrocyanide, $(CH_3)_4FeC_6N_6$, and hexamethyl ferrocyanogen dihydrogen sulphate, $(CH_3)_6FeC_6N_6H_2(SO_4)_2$ (*Trans.*, 1910, **97**, 1066, 1725), has been studied. The former, on heating with concentrated sulphuric acid, gave a mixture of ammonium and methylammonium sulphates, whilst the latter, under similar conditions, gave only methylammonium sulphate. Decomposition of the hexamethyl compound with sodium hydroxide also led only to the formation of methylamine derivatives. From this the conclusion is drawn that all the methyl groups are attached directly to nitrogen atoms in both the substances examined.

206. "Contributions to the chemistry of the terpenes. Part IX. The oxidation of camphene with hydrogen peroxide." By George Gerald Henderson and Maggie Millen Jeffs Sutherland. (Trans., 1911, 1539.)

Camphene, when dissolved in glacial acetic acid, is oxidised by a 30 per cent. aqueous solution of hydrogen peroxide, yielding a mixture of products, which includes both acids and neutral compounds. The acid present in largest quantity, *camphylic acid*, $C_9H_{15}\cdot CO_2H$, is a crystalline solid, m. p. 95°, and when heated with acetic anhydride is transformed into the isomeric *iso*camphenilanic acid. From the *chloride* of camphylic acid, $C_9H_{15}\cdot COCl$, by bromination and subsequent treatment of the product with water, *bromocamphylic acid*, $C_9H_{14}Br\cdot CO_2H$, was obtained in crystals, melting at 210°. When heated with aqueous sodium carbonate the bromo-acid is converted into the crystalline *hydroxycamphylic acid*, $C_9H_{14}(OH)\cdot CO_2H$, m. p. 245°. The latter does not give a ketone when oxidised with lead peroxide.

Camphenilone, $C_9H_{14}O$, a ketone which has been prepared from camphene in other ways, is the chief component of the mixture of neutral oxidation products. iso*Camphenilanaldehyde*, $C_9H_{15}\cdot CHO$, which is also present, is very similar in properties to the isomeric camphenilanaldehyde, but yields *iso*camphenilanic acid on exposure to the air. Its semicarbazone melts at 191—192°, and the semi-

carbazone prepared from camphenilanaldehyde appears in reality to be this compound. Among the other neutral products, together with a very little camphene glycol, $C_{10}H_{16}(OH)_2$, and a trace of a crystalline substance which melts at about 69°, there occurs a *compound* which apparently has the formula $C_9H_{16}O_2$. When heated to a high temperature with phthalic anhydride this compound yields a crystalline *ester*, from which, by hydrolysis, an *alcohol* of the formula $C_9H_{16}O$ is obtained.

207. "Synthesis of derivatives of thioxanthone. Part III. 1:4-Dihydroxythioxanthone." By Hans Thacher Clarke and Samuel Smiles. (Trans., 1911, 1535.)

When *p*-benzoquinone is allowed to react with *o*-thiolbenzoic acid, *2'-carboxy-2:5-dihydroxydiphenyl sulphide* is produced:

$$C_6H_4O_2 + HS\cdot C_6H_4\cdot CO_2H = C_6H_3(OH)_2\cdot S\cdot C_6H_4\cdot CO_2H.$$

The latter on treatment with cold sulphuric acid loses water, and is converted into *1:4-dihydroxythioxanthone*,

$$C_6H_4\!<\!\begin{matrix}CO\\S\end{matrix}\!>\!C_6H_2(OH)_2.$$

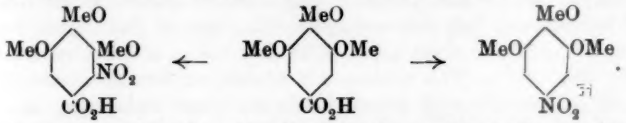
This substance and its salts are strongly coloured, but do not appear to be of practical value as dyestuffs.

208. "Optically active derivatives of 1-methyl*cyclo*hexylidene-4-acetic acid." By William Henry Perkin, jun., and William Jackson Pope. (Trans., 1911, 1510.)

The optical activity of *d*- and *l*-1-methyl*cyclo*hexylidene-4-acetic acid is due to the configuration of the molecule exhibiting a particular type of enantiomorphism unassociated with asymmetry of any particular atom present; the authors give the name "centroasymmetric" to this type of enantiomorphism. They now describe the conversion of optically active centroasymmetric compounds into substances containing an asymmetric carbon atom, and also the reverse change; they show that the optical activity of the original substance is preserved during the change in either direction. The change from the one to the other type of enantiomorphous configuration is thus unaccompanied by optical inversion.

209. "**Substitution in aromatic hydroxy-compounds. Part I. The action of nitric acid on gallic acid trimethyl ether and pyrogallolcarboxylic acid trimethyl ether.**" By Victor John Harding. (Trans., 1911, 1585.)

Gallic acid trimethyl ether on treatment with nitric acid under varying conditions undergoes the following reaction:



Pyrogallolcarboxylic acid trimethyl ether under similar conditions yields only the nitro-acid:

No substitution of the carboxyl group was observed. As the substitution of carboxyl groups by the nitro-group is partly dependent on its position in the molecule, the hypothesis is put forward that carboxyl-substitution is governed by those forces in the molecule which direct substitution in the parent phenol ether, and that there is no real difference between hydrogen-substitution and carboxyl-substitution.

210. "**The solubility of cuprous oxide in aqueous ammonia solutions, and the composition of the cuprous-ammonia complex.**" By Frederick George Donnan and John Smeath Thomas. (Trans., 1911, 1788.)

The solubility of crystalline cuprous oxide in solutions of ammonia of different concentrations has been determined at 25°. It is found that for a certain range of ammonia concentrations the concentration of total copper is approximately proportional to the square root of the "free" ammonia. From this result the conclusion is drawn that in these solutions the cuprous-ammonia hydroxide present is mainly of the type $(Cu{\cdot}NH_3)OH$.

211. "**The acid character of gallotannic acid.**" By Ramni Paniker and Edmund Stiasny. (Trans., 1911, 1819.)

The authors have applied Bredig and Fraenkel's method to the determination of the hydrion concentration of gallotannic acid.

This method is based on the dissociation of diazoacetic ester by the catalytical action of hydrions, the concentration of which determines the speed of the development of nitrogen. Different samples of gallotannic acid, prepared by different—and partly new—methods of purification, were used, and their acid character was found distinctly greater than could be explained by the presence of phenolic groups only, thus leading to the conclusion that free carboxylic groups are present. This confirms the views of Schiff and Nierenstein, but does not agree with those of Böttinger (*Ber.*, 1884, **17**, 1503), Walden (*Ber.*, 1898, **31**, 3170), and Dekker (*Ber.*, 1906, **39**, 2497). The authors are of the opinion that even the purest gallotannic acid obtainable is no single substance, but a mixture of at least two components of allied character.

212. "Synthesis of polypeptides of α-amino-*n*-nonoic acid with glycine, alanine, valine, leucine, asparagine, and aspartic acid." By Arthur Hopwood and Charles Weizmann. (Trans., 1911, 1577.)

As polypeptides of α-amino-*n*-nonoic acid with glycine and other amino-acids probably occur in the degradation products of the proteins contained in beetroot, the leaves of *Pelargonium roseum*, and other plants, the authors have prepared the following derivatives of α-amino-*n*-nonoic acid:

α-Bromo-n-*nonoyl chloride*, $C_8H_{16}Br{\cdot}COCl$, prepared by heating α-bromo-*n*-nonoic acid with phosphorus pentachloride, is a colourless liquid boiling at 108—110°/9 mm. When condensed with glycine in the presence of sodium hydroxide it gives *α-bromo*-n-*nonoylglycine*, $C_8H_{16}Br{\cdot}CO{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, which forms a mixture of colourless, rhombic plates and rhombic prisms, melting at 115·5—117°. The crystals are only sparingly soluble in cold water or benzene, but readily so in alcohol, ether, or alkalis.

α-Amino-n-*nonoylglycine*, $NH_2{\cdot}C_8H_{16}{\cdot}CO{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, is prepared by heating α-bromo-*n*-nonoylglycine with concentrated aqueous ammonia. It forms a mixture of colourless, monoclinic needles and rhombic plates, which sinters at 205°, and melts and decomposes at 215—216°. It is fairly soluble in water, almost insoluble in alcohol or benzene, but readily soluble in alkalis or mineral acids. Like the proteins, it yields a white, amorphous precipitate with phosphotungstic acid, but unlike the corresponding dipeptide, α-aminolaurylglycine, it is not hydrolysed by enzymes or bacteria.

Somewhat similar bromo-compounds are prepared by the condensation of α-bromo-*n*-nonoyl chloride with alanine, valine, leucine, asparagine, and aspartic acid, and these on heating with ammonia yield the corresponding dipeptides. Similarly, the tripeptide *leucyl-*

α-amino-n-*nonoylglycine* is prepared by condensing α-amino-*n*-nonoylglycine with α-bromo*iso*hexoyl bromide, and then displacing the bromine by an amino-group through the action of ammonia.

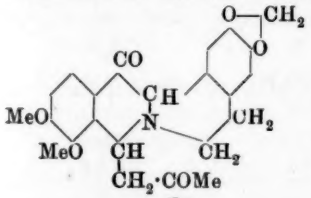
213. "Latent heats of vaporisation of mixed liquids. Part I."
By Dan Tyrer. (Trans., 1911, 1633.)

In order to determine the latent heats of mixed liquids the liquid is contained in a bottle provided with a thermometer ground into its neck. In the liquid is immersed a coil of platinum wire of known resistance, through which is passed a known current. The liquid, which has first been heated to its boiling point by an external bath, immediately boils, and the amount of liquid evaporated by the known amount of electricity is determined by weighing before and after. This gives all the necessary data. As, however, with mixed liquids the boiling point rises as the evaporation proceeds, a correction must be made for heat used in raising the temperature of the liquid. This is determined in a second experiment by determining the heat capacity of the liquid with the containing vessel.

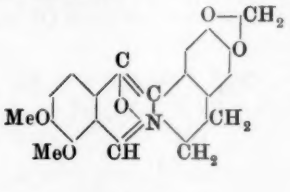
Measurements have been made for three cases of normal mixtures. The latent heat cannot be regarded as a linear function of the composition of the mixture, but depends also on the composition of the vapour.

214. "*iso*Quinoline derivatives. Part VI. *neo*Oxyberberine."
By Frank Lee Pyman. (Trans., 1911, 1690.)

Berberineacetone, $C_{23}H_{23}O_5N$, yields on oxidation with permanganate in aqueous acetone neo*oxyberberineacetone*, $C_{23}H_{23}O_6N$ (I). When this substance is hydrolysed by dilute acids, salts of neo*oxyberberine*, $C_{20}H_{17}O_5N$ (II), are obtained:



(I.)



(II.)

The phenolbetaine constitution assigned to *neo*oxyberberine is supported by its general properties, and particularly by its behaviour with methyl iodide, when *methoxyberberinium iodide* is produced. *neo*Oxyberberine is readily reduced to tetrahydrober-

berine, and its chloroform solution suffers spontaneous oxidation in the air, with formation of 1-keto-6 : 7-methylenedioxytetrahydro*iso*-quinoline and 1-ethyl hydrogen hemipinate.

215. "The system: palmitic acid–sodium palmitate." By Frederick George Donnan and Albert Simpson White. (Trans., 1911, 1668.)

The compositions of the solid and liquid phases in equilibrium with each other have been determined over the temperature-range 60—82°. The solid phases consist of three series of solid solutions. No pure acid salts appear to separate as stable phases in the region of temperature and concentration investigated.

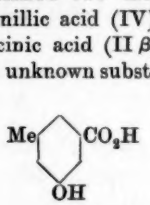
216. "The β-chlorocinnamic acids." By Thomas Campbell James. (Trans., 1911, 1620.)

The various methods for the preparation of the two β-chlorocinnamic acids have been examined, and the proportion of the isomerides obtained in each case determined. A quantitative separation is possible by means of the barium salts in aqueous solution; the *allo*-acid is readily, and the other sparingly, soluble.

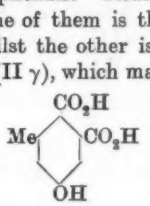
The transformation of the acid melting at 132·5° into that melting at 142° under the influence of heat and of sunlight, and the rate of elimination of hydrogen chloride by means of alkali, establishes the acid melting at 132·5° as the *allo*-isomeride.

217. "Substances related to cochenillic and carminic acids. Part I. Synthesis of the methyl ether of β- and of γ-coccinic acids." By Andrew Norman Meldrum. (Trans., 1911, 1712.)

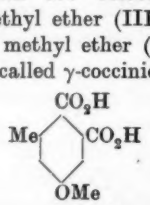
Starting with 5-hydroxy-*m*-toluic acid (I), the author has synthesised two methoxyphthalic acids which are related to cochenillic acid (IV). One of them is the methyl ether (III β) of β-coccinic acid (II β), whilst the other is the methyl ether (III γ) of an unknown substance (II γ), which may be called γ-coccinic acid.



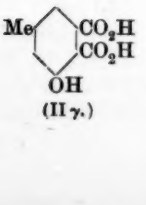
(I.)



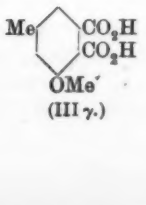
(II β.)



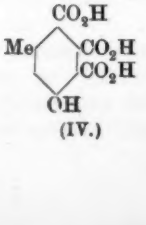
(III β.)



(II γ.)



(III γ.)



(IV.)

218. "The synthesis of hydrocarbons at high temperatures." By John Norman Pring and Dorian Macefield Fairlie. (Trans., 1911, 1796.)

A method has been applied for the detection of the synthesis of traces of hydrocarbons produced when pure carbon, in the form of a rod, is heated electrically in an atmosphere of hydrogen. At 1200°, and at pressures from 10 to 60 cm., carbon combines with hydrogen to give methane and ethylene, the rate of formation of the latter being about 1/100 that of the methane. No acetylene could be detected by this method at this temperature (1200°).

Measurements made of the rate at which acetylene and ethylene react with hydrogen to give methane show that sufficient time was not allowed in the above experiments for any large interaction of ethylene or acetylene with hydrogen to occur, so that the formation of the hydrocarbons must have been direct.

At 1400°, and at pressures between 10 and 40 cm., methane and acetylene are obtained, the rate of formation of the latter being about 1/10 that of the former.

At 1650° methane, ethylene, and acetylene are obtained, and, as at higher temperatures, the quantity of ethylene is about twice that of the acetylene.

Palladium, in contact with the carbon, was found to assist catalytically the formation of methane to the same degree as platinum, whilst silicon had no appreciable effect.

The presence of a highly charged electric field surrounding the carbon made no appreciable difference to the rate of formation of methane at temperatures between 1200° and 1600°, so that no complication is produced in the reaction by ionisation from heated carbon.

The formation of ethylene, which has not before been observed at these low temperatures, can just be detected by the special method employed for the analysis, at 1200°, and at 1400° it is comparable with the methane formed.

219. "2 : 2′-Dibromodiphenyl and 2 : 2′-dichlorodiphenyl." By James Johnston Dobbie, John Jacob Fox, and Arthur Josiah Hoffmeister Gauge. (Trans., 1911, 1615.)

The authors have studied the action of cuprous bromide on the tetrazonium salt derived from 2 : 2′-diaminodiphenyl. They show that, according to the conditions, the products are, on the one hand, mainly diphenyleneazone, $(C_6H_4N)_2$, and carbazole, and, on the other, a small amount of 2 : 2′-*dibromodiphenyl*, large quantities of carbazole, and traces of diphenyleneazone.

2:2′-Dibromodiphenyl crystallises from alcohol in long, colourless prisms, melting at 81°. Diphenylene is formed by the action of sodium on the substance dissolved in dry ether (*Trans.*, 1911, **99**, 683). Fluorene results from the action of sodium on a mixture of 2:2′-dibromodiphenyl and methylene dibromide.

2:2′-*Dichlorodiphenyl*, formed similarly to the dibromo-compound, crystallises from light petroleum in nodular masses of crystals, melting at 59°.

220. "The absorption spectra of various chlorine and bromine derivatives of benzene and of toluene as vapours, in solution, and in thin films." By John Edward Purvis. (Trans., 1911, 1699.)

The general results are that: (1) each vapour possesses a considerable number of bands which can be divided into groups, regulated by the type and number of the side-chains; (2) alcoholic solutions of the substances give considerably fewer bands, and of a different type from the vapour bands; and (3) the bands observed through very thin films are not unlike the solution bands, and differ only in position.

221. "The effect of heat on a mixture of benzaldehydecyanohydrin and aniline." By Arthur Ernest Everest and Hamilton McCombie. (Trans., 1911, 1752.)

The following substances were found to be produced in this reaction:

(1) After half an hour's heating a quantitative yield of anilinophenylacetonitrile, CN·CHPh·NHPh, is obtained. This substance has not been prepared previously without the use of either a sealed tube or a catalyst.

(2) If the heating is continued for forty-eight to ninety-six hours, *dibenzoyldianilinostilbene* (I) is formed:

(I.) (II.)

(3) Mixed with compound (I) was generally 1:2:4:5-tetraphenylglyoxaline (II). These two compounds were separated by taking advantage of the insolubility of the former in hot ether.

(4) α-Keto-β-anilino-αβ-diphenylethane was sometimes isolated in the reaction.

(5) Benzanilide was also found to be present.

Diberzoyldianilinostilbene can be decomposed quantitatively by potassium hydroxide, yielding the monobenzoyl compound and benzoic acid.

The constitution of these two compounds (the dibenzoyl and the monobenzoyl) was established by the decompositions undergone by *monobenzoyldianilinostilbene* (*a*) in solution, (*b*) on heating.

A solution of benzoyldianilinostilbene undergoes atmospheric oxidation, yielding benzanilide and dibenzoylaniline:

$$\begin{matrix}\mathrm{CPh{\cdot}NPhBz}\\ \|\\ \mathrm{CPh{\cdot}NHPh}\end{matrix} + \mathrm{O_2} \longrightarrow \mathrm{COPh{\cdot}NPhBz} + \mathrm{COPh{\cdot}NHPh}.$$

Benzoyldianilinostilbene when heated undergoes decomposition, regenerating the dibenzoyl compound, and forming benzanilide and benzildianil in addition:

$$\left.\begin{matrix}\mathrm{CPh{\cdot}NPhBz}\\ \|\\ \mathrm{CPh{\cdot}NHPh}\end{matrix}\right\} \longrightarrow \begin{matrix}\mathrm{CPh{\cdot}NPhBz}\\ \|\\ \mathrm{CPh{\cdot}NPhBz}\end{matrix} \quad 2\mathrm{COPh{\cdot}NHPh}$$

$$\left.\begin{matrix}\mathrm{CPh{\cdot}NHPh}\\ \|\\ \mathrm{CPh{\cdot}NPhBz}\end{matrix}\right\} \longrightarrow \begin{matrix}\mathrm{CPh{\cdot}NHPh}\\ \|\\ \mathrm{CPh{\cdot}NHPh}\end{matrix} \longrightarrow \begin{matrix}\mathrm{CPh{:}NPh}\\ \|\\ \mathrm{CPh{:}NPh}\end{matrix}$$

Benzoyldianilinostilbene is strongly yellow, but a colourless modification has been prepared. By spectroscopic means it has been established that the salts are derived from the colourless variety, and not from the yellow form.

222. "The formation and reactions of imino-compounds. Part XVI. Reactions leading to the formation of tricarballylic acid." By Ferdinand Bernard Thole and Jocelyn Field Thorpe. (Trans., 1911, 1684.)

Cyano-amides having the nitrile group in the γ-position readily pass into imino-derivatives of the five-membered ring; thus the condensation of iodoacetonitrile and the sodium compound of cyanoacetamide gives the imino-compound (I), from which the imide (II) can be produced by the action of acids, and ultimately tricarballylic acid (III):

$$\begin{matrix}\mathrm{CN{\cdot}C(CH_2{\cdot}CN){\cdot}CO{\cdot}NH}\\ \mathrm{CH_2}\text{———}\mathrm{C{:}NH}\end{matrix} \qquad \begin{matrix}\mathrm{CN{\cdot}C(CH_2{\cdot}CN){\cdot}CO{\cdot}NH}\\ \mathrm{CH_2}\text{———}\mathrm{CO}\end{matrix}$$

(I.) (II.)

$$\begin{matrix}\mathrm{CO_2H{\cdot}CH{\cdot}CH_2{\cdot}CO_2H}\\ \mathrm{CH_2{\cdot}CO_2H}\end{matrix}$$

(III.)

The imino-compound (IV) is produced when the sodium compound of ethyl cyanoacetate is condensed with iodoacetamide. It yields the imide (V) when treated with acids, and tricarballylic acid on further hydrolysis:

$$\mathrm{CO}\begin{matrix}\mathrm{NH{-}C{:}NH}\\ \mathrm{CH_2{\cdot}CH{\cdot}CH_2{\cdot}CO{\cdot}NH_2}\end{matrix} \longrightarrow \mathrm{CO}\begin{matrix}\mathrm{NH{-}CO}\\ \mathrm{CH_2{\cdot}CH{\cdot}CH_2{\cdot}CO{\cdot}NH_2}\end{matrix}$$

(IV.) (V.)

There is no tendency to form either the three- or the four-carbon ring through the agency of the imino-group.

223. "Composition of the essential oil of Myrica Gale, L." By Samuel Shrowder Pickles. (Trans., 1911, 1764.)

The oil of *Myrica Gale*, L. (bog myrtle, sweet gale, etc.) required for this investigation was distilled from specimens of the plant collected in Argyllshire. Two separate consignments of the raw material contained different proportions of leaves and twigs, and the oils obtained in the two cases consequently varied somewhat in character. The oil obtained from a sample consisting mostly of leaves was pale yellow. It had a pleasant, herb-like odour, and possessed the following chemical and physical characters:

Yield of oil on air-dried material, 0·203 per cent.; D_{15}^{15} 0·912; $\alpha_D - 11°26'$; acid value = 4·0; total saponification value = 23·2; ester value = 19·2; saponification value of acetylated oil = 56·4.

The constituents of the oil were found to include the following substances: (1) a crystalline paraffin hydrocarbon, m. p. 63—64°, having probably the composition $C_{29}H_{60}$ (0·75 per cent.); (2) free palmitic acid (2·5 per cent.); (3) terpenes, including dipentene; (4) cineole; (5) esters of fatty acids; (6) a mixture of alcohols of high boiling points; and (7) a sesquiterpene.

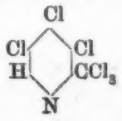
The cineole and terpenes together constitute approximately 50 per cent. of the oil.

224. "Trimercuridiethylammonium nitrite." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

By the interaction of ethylamine and mercuric nitrite, both dimercuriammonium nitrite and trimercuridiethylammonium nitrite are obtained; a large excess of ethylamine favours the formation of the latter. This new compound is of interest as being the alkyl-substituted product of mercuriammonium nitrite.

225. "The chlorine derivatives of pyridine. Part XI. Some interactions of 3 : 4 : 5-trichloropicolinic acid and of its derivatives." By William James Sell. (Trans., 1911, 1679.)

One of the chief compounds obtained by the chlorination of α-picoline has the constitution represented by the formula:



This substance has been shown to produce by the action of sulphuric acid—besides 3:4:5-trichloropicolinic acid and 3:4:5-trichloropyridine already described—a small quantity of another substance, most probably 4:5-*dichloro*-3-*hydroxypicolinic acid*. This substance is resolved by heat into the corresponding *dichlorohydroxypyridine*. The above hexachloropicoline also reacts with alcoholic sodium hydroxide, and yields 3:5-*dichloro*-4-*hydroxypicolinic acid*, also resolved by heat into the corresponding *dichlorohydroxypyridine*, isomeric with the above dichlorohydroxypyridine.

It is also shown that 3:4:5-trichloropicolinic acid yields, when heated with ammonia at 140°, 3:5-*dichloro*-4-*aminopicolinic acid*, which, when heated, gives 3:5-*dichloro*-4-*aminopyridine*.

Further, the last-mentioned compound forms, when the amino-group is replaced by the hydroxyl group, the same dichlorohydroxypyridine as is obtained by the action of alcoholic sodium hydroxide on the original hexachloropicoline and heating the dichlorohydroxypicolinic acid thus produced.

226. "An application of Kirchhoff's equation to solutions. (A contribution to the thermodynamic theory of solubility.)" By Robert Taylor Hardman and James Riddick Partington. (Trans., 1911, 1769.)

It is shown that a general differential equation of van't Hoff may be integrated by an application of a theorem of Kirchhoff relating to the influence of temperature on heat of reaction. The resulting equation gives the solubility of a substance in terms of the absolute temperature and three constants:

$$\log S = A - B/T - C\log T,$$

and is shown to agree very closely with the results of experiment.

227. "The aerial oxidation (rusting) of metals." By Wyndham Rowland Dunstan and John Richard Hill. (Trans., 1911, 1835.)

In continuation of previous work, the authors have investigated the cause of the inhibiting effect of certain substances, for example, alkalis, potassium dichromate, etc., on the rusting of iron and other metals. It has been found that this effect is in all cases the result of the establishment of a "passive" condition of the metal, during the continuance of which the metal does not rust. The effect persists long after the metal has been removed from the inhibiting solution and carefully washed with water. Contact of passive iron with certain salts or dilute acids, including carbonic acid, more or less rapidly destroys the passivity, and rusting ensues. The authors

point out that many of the results recently quoted in support of the carbonic acid theory of rusting are invalidated by the facts now recorded, and further evidence is produced in favour of the conclusion maintained in previous papers, that the presence of carbonic acid is not essential to the rusting process.

The authors record the results of experiments showing that the electrolytic theory of rusting cannot be maintained. It is also shown that other metals besides iron exhibit the phenomena of rusting, and are also capable of assuming the passive state.

228. "The passivity of iron and certain other metals." By Wyndham Rowland Dunstan and John Richard Hill. (Trans., 1911, 1853.)

The authors find that the passive state of iron is induced by solutions, in many cases by dilute solutions of a number of salts, such as potassium dichromate, chromate, iodate, chlorate, ferrocyanide, and also by alkalis and alkaline salts, and that, besides iron and metals of the iron group, other metals, including magnesium, lead, zinc, and copper, are also capable of assuming the passive state under the same conditions. Passivity is destroyed more or less rapidly by contact with solutions of certain salts, such as sodium chloride, and also dilute acids, including carbonic acid. It can also be removed by scratching or brushing the surface of the passive metal, as well as by other mechanical means.

The destruction of passivity by sodium chloride solution does not take place unless oxygen is present, and the effect is electrolytic, resulting in a slight electrolysis of the salt. In the absence of air, it is found that passivity is not destroyed by sodium chloride or by certain other salts.

The evidence obtained points strongly to the conclusion that passivity is the result of the formation of a film on the surface of the metal. The results of experiments show that this film probably does not consist of "physically" altered metal or of a gas film. The passivity of iron is destroyed by heating in a vacuum to 400°, and disappears when passive iron is heated in hydrogen to 240—250°, at which temperature it is known that magnetic oxide of iron is reducible by hydrogen. The observed facts point to the conclusion that "passivity" is probably the result of the formation of a solid film of oxide on the surface of the metal. It has not, however, been hitherto recognised that certain metals, and especially iron, are capable of oxidation through cold dilute alkaline solutions.

229. "The reactivity of ketones towards iodine and the relative rates of tautomeric change. Part II." By Harry Medforth Dawson and Harry Ark. (Trans., 1911, 1740.)

Further measurements have been made of the rate of tautomeric change of dialkyl ketones and substituted acetophenones. The experiments were made in 40 per cent. alcoholic solution with 0·1 molar sulphuric acid as catalyst, and iodine as speed indicator.

The rate of change of the symmetrical dialkyl ketones diminishes with increase in the number of carbon atoms in the alkyl group. The data for methyl propyl and methyl *iso*propyl, methyl butyl and methyl *iso*butyl ketones, show that substitution of the normal by the *iso*alkyl group reduces the reactivity of the ketone by about 25 per cent. The reactivity of methyl *tert.*-butyl ketone, in which the butyl group represents an inactive radicle, is only about two-fifths as great as that of the corresponding normal ketone. Substitution of a hydrogen atom of the phenyl group in acetophenone by a negative atom or group leads to a reduction in the rate of tautomeric change, and similar substitution of one of the hydrogen atoms of the methyl group appears to prevent the change from taking place.

230. "The photochemical and thermal interaction of chlorine and carbon monoxide." By David Leonard Chapman and Frank Houghton Gee. (Trans., 1911, 1726.)

The authors have continued the investigation of the inhibition observed in photochemical changes when certain impurities are present in very small amounts. The substances which hinder the photochemical interaction of carbon monoxide and chlorine are those which act as inhibitors towards the action of chlorine on hydrogen under the influence of light. The effect of oxygen on the former change has been investigated quantitatively. The thermal union of chlorine and carbon monoxide is homogeneous in character under the conditions prevailing in the experiments performed, that is, when the action proceeds in glass vessels and the area of glass is not extremely large in comparison with the size of the vessel in which the change takes place. The most important conclusion drawn from the results is that the afore-mentioned inhibition is limited to the photochemical change: the inhibitors in question have no influence on the thermal change. This fact was established by measurements being made of the rate of union of chlorine and carbon monoxide in the light and in the dark, at a temperature of 315°, both in the presence and in the absence of

nitrosyl chloride. When nitrosyl chloride was present, the rate of union was the same in the dark as in the light; but when it was absent, the rate of union in the light was the greater, the rate of union in the dark being the same as that observed when nitrosyl chloride had been admitted to the mixture.

231. "Decomposition of dry ozone." By David Leonard Chapman and Herbert Edwin Jones. (Trans., 1911, 1811.)

Ozone desiccated by long exposure to phosphoric oxide, and ozone dried by contact with concentrated sulphuric acid, decompose at the same rate under the same conditions. From this result, and from the results obtained in a previous research by the same authors (*Trans.*, 1910, **97**, 2463), the inference is drawn that ozone can revert to oxygen without the intervention of any other substance.

232. "The absorption spectra of the isomeric hydrazones and semicarbazones of camphorquinone." By Frederick Russell Lankshear and Arthur Lapworth. (Trans., 1911, 1785.)

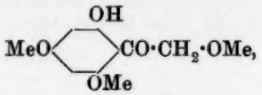
The spectra fall into two sets, suggesting a classification of the compounds into two series which are identical with the α- and β-series into which they were grouped by Forster and Zimmerli (*Trans.*, 1910, **97**, 2156; 1911, **99**, 478). The points of difference between the two classes are not sufficiently marked appreciably to weaken the case in favour of the view that the relationship is stereochemical.

233. "Bimolecular glycollaldehyde." By Nial Patrick McCleland. (Trans., 1911, 1827.)

The author has investigated the behaviour of bimolecular glycollaldehyde in different solvents and in the state of vapour to ascertain whether it is a kind of acetal formed from two molecules, the hydroxyl group of the one reacting with the aldehyde group of the other and vice versa, or whether the phenomenon is due to molecular association of an unusually intense kind. The conclusion is drawn that the latter is the case, and with the aid of the absorption spectrum of the bimolecular solution it is found possible to make a suggestion as to the character of association in general.

234. "Myricetin. Part III." By Arthur George Perkin. (Trans., 1911, 1721.)

Myricetin hexamethyl ether, $C_{15}H_4O_2(OMe)_6$, which occurs in colourless, prismatic needles, melting at 154—156°, is readily prepared by the action of methyl sulphate on the potassium salt of myricetin pentamethyl ether (compare Waliaschko, *Arch. Pharm.*, 1904, **242**, 242), or by methylating myricetin with alkali and methyl sulphate. When hydrolysed with alcoholic potassium hydroxide, it gives gallic acid trimethyl ether and 2-hydroxyfisetol trimethyl ether:



identical with that obtained by Herzig from quercetin pentamethyl ether (*Ber.*, 1909, **42**, 158). Myricetin hexaethyl ether (*Trans.*, 1902, **81**, 206) behaves similarly, with production of gallic acid triethyl ether and *2-hydroxyfisetol triethyl ether*, which forms prismatic needles, melting at 96—97°. These results confirm the hydroxy-quercetin constitution previously assigned to myricetin.

235. "The influence of inactive electrolytes on the optical activity of *l*-malic acid in aqueous solution." By Clifford Morgan Stubbs.

The addition to an optically active solution of various salts and acids which themselves are inactive and do not chemically combine with the active solute, provides a method of varying the solvent in a simple and more or less understood manner. Malic acid was selected as being a well-studied active substance, particularly sensitive to changes in the solvent. For comparative purposes a solution of malic acid of constant strength (20 per cent.) was used, to which the various anhydrous salts and acids were added in certain equivalent proportions, and their effect on the specific rotation, mainly for sodium light, determined. The influences observed were, in general, considerable, those for barium and calcium salts being extraordinarily large, and showed the existence of simple relations between the influence of the salt and its chemical nature. The main conclusions are:

(1) The influence of salts is not due to their affinity for water.

(2) The influence is mainly a property of the radicles or ions; for salts of strong bases it is an additive ionic property.

(3) The property is not due to chemical reaction or adjustment

of ionic equilibrium. Ions within the sphere of influence of an active molecule appear to possess the specific power of affecting its degree of asymmetry to an extent depending mainly on their concentration, and not on that of the malic acid. No connexion has been found between this power and any known physical properties of the solvent due to the dissolved electrolyte.

(4) The divergencies of the alkaline malates (according to Schneider's data) from obeying Oudeman's law appear explicable on the ground of the continued influence of the dissociated, but necessarily adjacent, metal ion.

(5) Thomsen's supposed complex-formation between sodium malate and excess of alkali seems explicable on the ground of ionic influence.

236. "New derivatives of diphenoquinone and a new variety of stereoisomerism" By James Moir.

By oxidising 4 : 4′-dihydroxy-3 : 3′-ditolyl in various ways, *ditoluquinone* has been obtained apparently in two stereoisomeric forms, namely, a 3 : 3′- or *cis*-form (red) and a 3 : 5′- or *trans*-form (yellow). Both modifications give an orange-brown coloration with sulphuric acid, and are quantitatively reduced by stannous chloride to 4 : 4′-dihydroxy-3 : 3′-ditolyl. On mild oxidation, dihydroxyditolyl gives *ditoluquinhydrone*, which forms black needles with a green reflex, and gives a blue coloration with sulphuric acid; the sodium derivative is a bluish-purple jelly. *Ditoluquinonedi-imine* results by oxidising tolidine by Willstätter's method, and is similar to his "diphenoquinonedi-imine," but the properties of both are anomalous, and they are probably polymerides of the true di-imines.

The nitrate of the true *ditoluquinhydronedi-imine* is easily obtained from tolidine nitrate and ferric nitrate in aqueous solution; it forms opaque, blue needles with a bronze lustre, and is hydrolysed by water, the blue solution depositing the *basic nitrate* as a bright blue jelly with a coppery lustre, which can be prepared directly by the action of the theoretical amount of chromium trioxide on tolidine nitrate. When excess of potassium dichromate is used instead, the *dichromate* of *ditoluquinhydronedi-imine*

$$(C_{14}H_{14}N_2 + C_{14}H_{16}N_2 + H_2Cr_2O_7)$$

is obtained; this is the tetramethyl derivative of the so-called "benzidine chromate," which has recently been shown to be diphenoquinhydronedi-imine dichromate.

Dibromoditoluquinone has been isolated in two modifications by oxidising 5 : 5′-dibromo-4 : 4′-dihydroxy-3 : 3′-ditolyl; it forms scarlet needles with a faint green lustre, and paler lozenges. It gives a

scarlet coloration with sulphuric acid, becoming magenta on dilution. Like the parent substance, it is practically unaffected by sodium hydroxide. The corresponding *quinhydrone*

$$(C_{14}H_{10}O_2Br_2 + C_{14}H_{12}O_2Br_2)$$

is obtained by reducing the quinone with bisulphite, or directly from dibromodihydroxyditolyl by oxidation with ferric chloride in dilute alcohol, or with bromine in acetic acid. It forms needles like graphite, giving a blue coloration in sulphuric acid; the sodium derivative is bright blue, and easily decomposed.

The following new substances are described: 5:5′-*dibromo*-4:4′-*dibenzoyloxy*-3:3′-*ditolyl*, m. p. 239°; the 4:4′-*diacetoxy*-compound, m. p. 198°; 5-*bromo*-6-*hydroxy*-m-*toluic acid*, m. p. 233°; 3-*bromo*-3′-*nitro*-4:4′-*dihydroxy*-3:3′-*ditolyl*; 5:5′-*dinitro*-4:4′-*dihydroxy*-3:3′-*ditolyl*; and *barium* 4:4′-*dihydroxy*-3:3′-*ditolyldisulphonate*.

Thursday, October 19th, 1911, at 8.30 p.m., Professor Percy F. Frankland, LL.D., F.R.S., President, in the Chair.

The President referred to the loss sustained by the Society, through death, of the following Honorary and Foreign Members:

	Elected.	*Died.*
Prof. Albert Ladenburg	Feb. 2nd, 1888	Aug. 15th.
Prof. Walthere Spring	Jan. 20th, 1898	July 17th.
Prof. Louis Joseph Troost	„ „ „	Sept. 30th.

It was announced that the Berthelot Memorial Lecture would be delivered by Professor Harold B. Dixon, F.R.S., on Thursday, November 23rd, 1911, at 8.30 p.m.

Messrs. Irvine Masson, Edwin B. Hughes, H. Horace Ward, and L. O. Newton were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Arthur Cecil Bescoby, B.A., Guestling, Hastings.

Bertram Alfred Bull, Government Road, Nairobi, British E. Africa.

Joseph Beauchamp Bull, Bulawayo, S. Africa.

Edwin Johnson Charlton, M.Sc., Morannedd, Beaumaris, North Wales.

Barun Chandra Dutt, M.A., Rambogan Cottage, Rambogan, Calcutta.

Arthur Josiah Hoffmeister Gauge, 2, Ashford Avenue, Hornsey, N.

Sydney Hall, B.Sc., Birley House, Station Road, March.

Cyril Vincent Hodgson, 80, Apedale Road, Chesterton.

Henry James Hodsman, M.Sc., 2, Richmond Hill, Langley, Birmingham.

Alexander Frederick Hogg, M.A., 81, Claremont Road, Forest Gate, E.

Robert Mills, Plantation Uitolugt W.C., Demerara, British Guiana.

B. Wiswa Nath, 46, Nagappa Modali Street, Komaleswarapet, Madras, India.

Thomas Peers Parkes, B.Sc., 22, Dalrymple Road, Brockley, S.E.

David Henry Peacock, B.A., B.Sc., 40, Huddart Street, Bow, E.

B. Venkata Rao, B.A., Bangalore, Mysore, India.

Joseph Reilly, B.A., 25, South Circular Road, Portobello, Dublin.

Noël Douglas Ridsdale, Ravenscroft, Roman Road, Middlesbrough.

William Bristow Saville, 117, Vassall Road, Brixton, S.W.

Bernard Charlie Smith, 62, Filey Avenue, Upper Clapton, N.E.

John Henry Smith, 10, Radnor Street, Swindon.

Kapibram H. Vakil, B.A., B.Sc.Tech., No. 5, Santa Cruz, Bombay, India.

Harry James Vipond, B.A., Dept. of Agriculture, Pretoria, S. Africa.

Ernest Walter Wright, Connaught Club, Seymour Street, W.

Of the following papers, those marked * were read:

***237. "The alkaline condensations of nitrohydrazo-compounds." By Arthur George Green and Ernest Arthur Bearder.**

The authors have studied the action of aqueous alkali hydroxides on 4:4′-dinitrohydrazobenzene, and have ascertained that condensations occur analogous to those which give rise to the stilbene dyestuffs. A close parallelism is thus indicated between the nitroazo- and the nitrostilbene series.

The blue colour produced when 4:4′-dinitrohydrazobenzene is dissolved in cold alkali hydroxides is apparently due to the formation of the quinonoid salt:

$$(M'O)NO{:}C_6H_4{:}N{\cdot}N{:}C_6H_4{:}NO(OM'),$$

since the original compound is reprecipitated unchanged when the

freshly prepared solution is acidified. When, however, the solution is kept at the ordinary temperature for several hours, a slow change of colour from pure blue to violet-blue occurs, with simultaneous precipitation of dinitroazobenzene. The solution after removal of the latter then gives on acidification *4-nitroso-4′-nitrohydrazobenzene*, $NO{\cdot}C_6H_4{\cdot}NH{\cdot}NH{\cdot}C_6H_4{\cdot}NO_2$, which crystallises from acetone in small, orange-red cubes having a violet reflex, and decomposes without melting sharply at about 203°. Its alkali salts are violet-blue.

It is rather unstable, and when boiled with neutral solvents or with aqueous alkali hydroxides undergoes further condensation according to the scheme:

$$NO_2{\cdot}C_6H_4{\cdot}\boxed{\overset{H}{N}{\cdot}\overset{H}{N}{\cdot}C_6H_4{\cdot}\overset{O}{N}} \longrightarrow \longleftarrow \boxed{\overset{O}{N}{\cdot}C_6H_4{\cdot}\overset{H}{N}{\cdot}\overset{H}{N}}{\cdot}C_6H_4{\cdot}NO_2\,'$$

giving *bisnitrobenzeneazo-azobenzene*. The latter can also be obtained without prior isolation of the intermediate nitroso-derivative by heating the alkaline solution of dinitrohydrazobenzene for some time at 100° until the disappearance of the blue colour. It forms small, orange-red needles, is very sparingly soluble in solvents, and melts at 285—286°.

***238. "The characteristics and chemical composition of some early matches." By Edwy Godwin Clayton.**

A description was given, and specimens were shown, of the Promethean match (date 1828), one of the numerous forms of "chemical matches" (ignited by the contact of sulphuric acid with a chlorate mixture) which preceded the non-phosphoric "friction-lights," invented in 1826–1827 by John Walker, and ignitable when drawn through folded sand paper. Some of the non-phosphoric "lucifer matches," which were soon afterwards manufactured in many quarters on the same principle as Walker's matches, but were usually sulphur-coated (Walker's were not, although the opposite is sometimes stated to be the case), were also described, and specimens were exhibited. The author has fixed the identity of the first user of the designation "Lucifers." It was Samuel Jones, who, having previously introduced the Prometheans, next manufactured friction matches closely resembling Walker's, and called them "Jones's Lucifers," or "chlorate matches." Analyses of Prometheans, and of two varieties of lucifer matches, British and foreign, are summarised in table I. Many inaccurate statements have been made about the Promethean matches, especially in reference to

the composition of the igniting mixture, and the character of the glass vessel containing the acid. The last-named differs widely from that which most of the published descriptions would lead the reader to expect.

TABLE I.

	Class : Chemical Matches.		*Class : Lucifer Matches.*	
	Promethean Matches. Maker, S. Jones. Date, 1828. Igniting composition.	*The same.* Liquid in minute glass tube.*	No. 1. *English "Lucifer Matches."* Maker, R. Bell & Co. Date, 1832–33.	No. 2. *French Matches (Lucifers).* Maker's name unknown. Date, 1832–33.
Sulphur	24·7	—	6·5	12·5
Antimony sulphide	—	—	24·6	18·1
Lycopodium	8·8	—	—	—
Potassium chlorate	34·9	—	27·6	41·0
Ferric oxide	—	—	5·6	3·5
Gum	31·6	—	35·7	24·9
Sulphuric acid (H_2SO_4)	—	61·9	—	—
Water	—	38·1	—	—
Indigo	—	(minute quantity)	—	—
	100·0	100·0	100·0	100·0

* Tube about 7 mm. long and 1 mm. wide.

Early in the 'thirties were introduced "Congreve" matches, which differed from lucifers in that they contained phosphorus, and were ignitable by being "struck upon the box." Congreves, which were probably so named after the inventor of the war rocket, Sir W. Congreve, Bt., then recently deceased, were largely manufactured on the Continent, especially in Germany and Austria. They varied greatly in quality and appearance, although not much in composition. In table II are given the results of analyses of six kinds of Congreves. Some curious "Cigarren Zünder" (phosphoric, and ignitable by friction), made about 1850 by a Viennese manufacturer, and Austrian matches of later date (included in table II), were also described.

TABLE II.

TABLE II.

Class: Congreve Matches.

	No. 1. *German* (?) *Matches.* Labelled: "Best London Congreves." No maker's name. (Period, between 1838 and 1840.)	No. 2.* *German Matches.* On the label: "These matches invented and improved by Congreve . . ." Also an illustration of a hand *striking a match.* Matches packed in bran . . . Maker's initials "J.C.K." (Supposed date c. 1835.)	No. 3. *German Matches.* "Chemische Streich-feuerzeuge." Maker, H. Link, of Darmstadt (Period, probably earlier than 1840.)	No. 4. *German Matches.* Labelled: "Superior Congreves from one of the greatest and most famous German manufactories." Maker's initials "I.N.E." (Period, 1840—50.)	No. 5. *German Matches.* Labelled: "Superior Congreve matches from one of the greatest and most famous German manufactories." Maker's initials "I.N.E." (Period, 1840–50.)	No. 6. Rubbing composition on the boxes of No. 5.	No. 7. *Austrian Matches.* Initials, "B.F. in S." (Bernard Fürth of Schüttenhofen ?) (Period, 1845—50.)	*Class: Matches of later date.* No. 8. *Austrian Matches.* Maker and date unknown. (Period probably later than any of the preceding.)	*Class: Cigar Lighters.* No. 9. *Austrian Cigar Lighters.* "D'Bleaml'n Cigarren Zünder." Maker, A. N. Pollak, Vienna. (Date, c. 1850.)
Ordinary phosphorus	10·5	20·5	13·0	6·9	7·7	—	17·8	5·5	7·1
Sulphur	12·7	14·3	9·0	20·4	6·7	—	11·5	3·2	10·2
Potassium chlorate	43·3	32·1	60·7	39·0	38·8	—	37·4	54·8	20·0
Potassium nitrate	—	—	—	—	—	—	—	—	11·4
Glass (pulverised)	—	—	—	—	14·9	—	—	—	2·6
Sand	—	—	—	—	—	32·8	—	—	—
Chalk or whitening	12·5	8·0	—	—	6·3	—	—	—	—
Ferric oxide	—	—	—	—	—	41·2	—	—	11·8
Gum	21·0	—	—	—	—	—	33·3	36·5	—
Dextrin, etc.	—	25·1 (Wheat starch present)	17·3 (Much starch)	—	—	—	—	—	—
Starch	—	—	—	—	—	—	—	—	—
Glue	—	—	—	33·7	25·6	26·0	—	—	36·9
Dye	(Traces)	(Minute quantity of a blue dye)	(Blue dye)	—	(Prussian blue)	—	?	?	—
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0

* These were probably among the phosphoric friction matches earliest sold in this country.

***239. "Experiments on the Walden inversion. Part VII. Action of phosphorus pentachloride and of thionyl chloride on optically active hydroxy-acids and esters." By Alex. McKenzie and Fred Barrow.**

The authors have examined the action of thionyl chloride on *l*-mandelic acid, methyl *l*-mandelate, ethyl *l*-mandelate, *l*-malic acid, ethyl *l*-malate, ethyl *d*-tartrate, *l*-α-hydroxy-β-phenylpropionic acid and its ethyl ester, and *d*- and *l*-β-hydroxy-β-phenylpropionic acids. The action of phosphorus pentachloride has been examined in the case of *d*- and *l*-α-hydroxy-β-phenylpropionic acids and their ethyl esters, and also in the case of *d*-β-hydroxy-β-phenylpropionic acid. The behaviour of the latter acid and its *l*-isomeride towards hydrochloric acid has also been studied.

Discussion.

The President asked Dr. McKenzie whether he had observed any differences in the amount of racemisation occurring according as phosphorus pentachloride or thionyl chloride respectively were employed, and also according as the free acid or an ester respectively were acted on by these reagents.

In reply to the President, Dr. McKenzie stated that a Walden inversion is accompanied in the great majority of cases by racemisation, which is often very pronounced. When the action of phosphorus pentachloride and of thionyl chloride towards any one hydroxy-acid (or its ester) is contrasted, it is found that the former has invariably a greater racemising influence than the latter; thus, the crude dextrorotatory phenylchloroacetic acid obtained by the action of phosphorus pentachloride on *l*-mandelic acid is optically active to a much less degree than the crude lævorotatory phenylchloroacetic acid obtained by the action of thionyl chloride on *l*-mandelic acid. A similar effect was noted in the behaviour of *l*-atrolactinic acid towards phosphorus pentachloride and thionyl chloride respectively (McKenzie and Clough), and there are numerous other instances of the same kind.

In reply to Dr. Forster, it was stated that the method recently described by Darzens (*Compt. rend.*, 1911, **152**, 1601) of replacing the hydroxy-group by chlorine by the action of thionyl chloride on esters of hydroxy-acids in the presence of a tertiary base was not attempted by the authors. By the action of thionyl chloride on ethyl *l*-malate studied by the authors, a satisfactory yield of ethyl *d*-chlorosuccinate with $[\alpha]_D^{19\cdot8} + 32\cdot7°$ was readily obtained, whereas Darzens, carrying out the action in the presence of pyridine, found $[\alpha]_D^{20} + 31\cdot2°$.

***240. "Note on the preparation of the *syn.*-aldoximes." By Albert Ernest Dunstan and Ferdinand Bernard Thole.**

The method for the preparation of benz-*syn*-aldoxime discovered by Beckmann (*Ber.*, 1889, **22**, 429, 1531) consists in saturating an ethereal solution of the *anti*-oxime with dry hydrogen chloride and subsequently decomposing the precipitated hydrochloride with aqueous sodium carbonate.

The authors have found that a much more simple and expeditious preparation can be performed by suspending the finely powdered *anti*-oxime in cold concentrated hydrochloric acid, and leading in hydrogen chloride to saturation, when, in the case of benzaldoxime, the hydrochloride passes into solution, and, in the case of piperonaldoxime, the salt is precipitated.

On pouring the resulting solution or suspension into excess of aqueous sodium carbonate, a voluminous precipitate of the *syn*-modification appears, which can be collected, dried on porous earthenware, and crystallised from benzene. Almost theoretical yields have been obtained in the cases of benzaldoxime, piperonaldoxime, anisaldoxime, and *m*-nitrobenzaldoxime.

***241. "The absorption spectra of the nitration products of dimethyl-*p*-toluidine." By Gilbert T. Morgan and Arthur Clayton.**

2-Nitrodimethyl-*p*-toluidine and 3-nitrodimethyl-*p*-toluidine exhibit absorption spectra quite comparable with those of the nitroanilines and nitrotoluidines, the absorption curves showing the broad, well-defined band which is characteristic of this series of bases.

2 : 5-Dinitrodimethyl-*p*-toluidine, which contains its nitro-groups unsymmetrically arranged on either side of the dimethylamino-radicle, gives an absorption curve still showing the characteristic band, but somewhat narrowed and modified. 2 : 6-Dinitrodimethyl-*p*-toluidine and 3 : 5-dinitrodimethyl-*p*-toluidine, in each of which the two nitro-groups are in symmetrical positions with respect to the basic group, give absorption curves differing from the typical form, owing to the almost complete suppression of the absorption band.

The substitution of a third nitro-group in the 2 : 6-isomeride decreases the symmetry of the molecule, and the product, 2 : 3 : 6-trinitrodimethyl-*p*-toluidine, again shows a well-defined absorption band.

The least symmetrical base examined was 2 : 3-dinitromethyl-*p*-toluidine, which contains all its substituents in consecutive

positions. This substance gave the typical form of absorption curve with the most persistent band of the series.

The observed difference between the absorption spectra of 2 : 6- and 3 : 5-dinitrodimethyl-*p*-toluidines and those of the other bases of this group is due, however, only in part to the symmetrical grouping of the nitro-groups; it is dependent, also, on the presence of the unsaturated basic radicle, for when the basicity is largely destroyed by the replacement of an *N*-methyl by a nitroso-group, similar spectra are exhibited, as, for example, with 3 : 5-dinitro-*p*-tolylmethylnitrosoamine, 2 : 5 - dinitro-*p*-tolylmethylnitrosoamine, and the corresponding *N*-nitroamine.

242. "The action of Allium sativum or garlic-juice on lead and mercury." By Manindranath Banerjee.

When the juice of macerated garlic-cruciferæ is triturated with highly impure mercury (containing lead) in a mortar for several hours, a pasty mass adheres to the sides of the mortar, and the mercury remains behind. On adding water to the pasty mass, after removing the mercury, a greyish-black precipitate is formed, which, after being collected, dried in the air, and rendered free from minute particles of mercury, proves to be a mixture of lead sulphide (PbS) and a little mercuric sulphide (HgS). The mercury which has been removed, being partly free from lead and other impurities, is repeatedly subjected to the same treatment with garlic-juice, and after three or four hours' rubbing, it is seen to be quite free from lead, and shows all the qualities of pure mercury, when the garlic would no longer act on it.

The sulphur present in the garlic acts on the lead to form lead sulphide (PbS). The higher sulphides present in the oil of garlic, such as diallyl disulphide, propyl allyl disulphide, etc., are reduced to the lower ones, for example, diallyl disulphide is changed into diallyl sulphide or allyl sulphide; this oily liquid mixes with the lead sulphide to form a pasty mass. On adding water, the allyl sulphide and gummy matter present in garlic are dissolved, and lead sulphide is precipitated. The allyl sulphide is partly converted into allyl alcohol, hydrogen sulphide being evolved, which at once attacks the mercurous oxide always present in impure mercury, forming black mercurous sulphide ($HgS + Hg$) and water. The lead and mercuric sulphides are separated from the mercury, which is thus obtained completely free from lead and mercurous oxide, and is found to be perfectly purified. It has been observed that garlic has no action on pure mercury, and its action on lead alone, even in the finest state of division, is extremely slow, whilst it

readily attacks an amalgam of mercury and lead. In the case of diallyl disulphide the reaction may be represented thus:

$$(C_3H_5)_2S_2 + Pb = (C_3H_5)_2S + PbS,$$
$$(C_3H_5)_2S + 2H_2O = 2C_3H_5{\cdot}OH + H_2S,$$
$$H_2S + Hg_2O = Hg_2S \text{ or } (HgS + Hg) + H_2O;$$
$$\text{or, } (C_3H_5)_2S_2 + Pb + Hg_2O = 2C_3H_5{\cdot}OH + (PbS + HgS) + H_2O + Hg.$$

243. "Note on *p*-methoxysalicylaldehyde and its occurrence in the root of a species of Chlorocodon." By Ernest Goulding and Russell George Pelly.

In a previous note (*Proc.*, 1908, **24**, 62) it was shown that the odorous constituent of the roots of *Chlorocodon* sp., is the methyl ether of a dihydroxybenzaldehyde, $OMe{\cdot}C_6H_3(OH){\cdot}CHO$, m. p. 41—42°, but that owing to the lack of sufficient material its configuration had not been established.

A further quantity of the root was subsequently received at the Imperial Institute from Uganda, and was distilled with steam, the yield of the aldehyde amounting in this case to little more than 0·25 per cent., as compared with 0·5 per cent. from the earlier sample.

When the compound was fused with potassium hydroxide it furnished either β-resorcylic acid or resorcinol, depending on the temperature at which the experiment was carried out, thus proving that the substance is *p*-methoxysalicylaldehyde,

$$OMe{\cdot}C_6H_3(OH){\cdot}CHO[4:2:1].$$

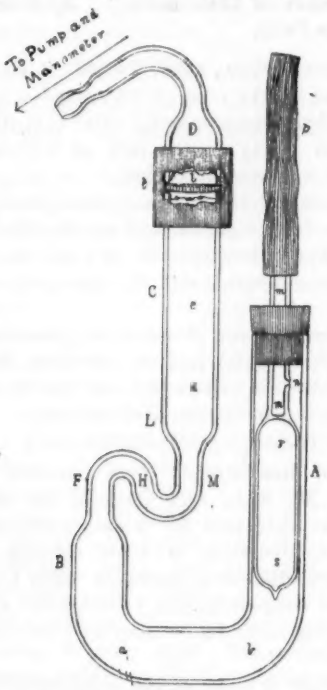
This conclusion has already been reached by Friedländer (*Monatsh.*, 1910, **30**, 879), who obtained the compound by the action of sodium hydroxide on 4-methoxybenzene-2-indoleindigo (formed by the condensation of isatin chloride with resorcinol methyl ether). Friedländer's substance melted at 41°, and was identified with the compound from *Chlorocodon* roots by means of the oxime and phenylhydrazone described in the earlier paper (*loc. cit.*).

When an alcoholic solution of the aldehyde (1 mol.) is warmed with aniline (1 mol.), condensation readily takes place, with formation of *p-methoxysalicylideneaniline*, $OMe{\cdot}C_6H_3(OH){\cdot}CH{:}NPh$, which separates in long, narrow, lustrous, yellow plates, and, after recrystallisation from alcohol, melts at 67—68°:

0·4410 gave 23·5 c.c. N_2 (moist) at 12·5° and 750 mm. N = 6·22.
$C_{14}H_{13}O_2N$ requires N = 6·17 per cent.

244. "A simple apparatus for sublimation in a vacuum." By Harold Christopher.

In the course of some recent researches on thioxanthones it was desired to purify these substances by sublimation in a vacuum. It was found, however, that, owing to the great density of the vapours, diffusion to the cold part of the sublimation tube was an exceedingly slow process. To overcome this difficulty the idea was conceived of



drawing a current of air over the substance, and for this purpose the apparatus illustrated by the accompanying figure was designed. Essentially it consists of a glass tube *ABCD*, of which the region *ab* contains the substance to be sublimed, and is heated in an oil- or metal-bath, whilst the limb *C*, into which the vapours of the substance are carried by a current of air, serves as the cooling chamber. In order to prevent the sublimate which collects in the region *de* from falling back on the unsublimed substance, the tube

is constricted and bent, as shown at *FHM*, and to avoid condensation and consequent blocking at this part, the apparatus is immersed in the bath up to the level *L*. The current of air, which is regulated by means of a screw-clip compressing the indiarubber tube *p*, enters the apparatus through the glass tube *mm*, from which it issues by the orifice *n*, and passes down the cylindrical space between the outer wall of the sealed and exhausted tube *rs* and the inner wall of the limb *A* of the sublimation tube. From here it passes over the substance to the condensing limb *C*, and thence through a filter, shown in section at *l*, to the pump. This filter, which is of great importance, the outlet tubes invariably becoming choked if it is omitted, consists of a piece of filter-paper held against the under-surface of a perforated porcelain disk. It rests on the end of the condensing limb, and is held in place by the head *D* and the thick rubber band *t*. Should the tube *rs* be omitted, vortices are formed, and some of the vapour of the substance is carried to the cool part of the limb *A*, where it condenses. It is not essential that this tube should be sealed at the junction with *m*, but it is perhaps preferable, as any contamination of the inside would be very troublesome to remove. If it is sealed it is safer to exhaust it, at least as completely as is possible, with a water-jet pump, since, when in use, it is surrounded by an atmosphere at low pressure and high temperature. Some idea of the amount of air passing may be obtained by inserting a mercury bubbler between the apparatus and the pump. The substance to be sublimed is, of course, introduced through the limb *A*, and the sublimate scraped out of the limb *C*, the head and filter being removed for the purpose.

This device has proved of great utility in the researches alluded to above. The external diameter of the tube employed was five-eighths of an inch, and the total height about 7 inches. The working pressure was usually about 40 mm. (internal), at which a quite sufficiently rapid stream of air was drawn through by the water-jet pump used, whilst the temperature was in the neighbourhood of 200°.

245. "Note on the dehydration of crystals."
By James Brierley Firth.

The removal of water of crystallisation from various salts by means of calcium carbide has been described by Irvine Masson (*Trans.*, 1910, **97**, 851), who finds that in most cases complete dehydration can be obtained, the rapidity of dehydration depending on the vapour pressure of the hydrate.

In the case of copper, zinc, and magnesium sulphates, the final stage is that of the monohydrate.

The author has conducted a series of similar experiments, using phosphoric oxide, and it was found that the above sulphates could be rendered completely anhydrous. The extent of the dehydration was determined by taking the monohydrate, and in all three cases it was further dehydrated by phosphoric oxide.*

It would appear, therefore, that the apparent stability of the monohydrate, when calcium carbide is used, must be due to the conditions under which the dehydration is carried out.

The decomposition of calcium carbide results in the production of calcium hydroxide. Now it would appear that, if during dehydration any hydrate was formed which had a vapour pressure equal to, or lower than, that of calcium hydroxide, further dehydration would not be possible.

From the following table it will be seen that this is the case with copper, zinc, and magnesium sulphates.

Vapour pressures at 25°.*

$CuSO_4,5—3H_2O$	7·0 mm.		$MgSO_4,6—7H_2O$	11·5 mm.	
$CuSO_4,1—3H_2O$	4·7 ,,		$MgSO_4,5—6H_2O$	9·8 ,,	
$CuSO_4,0—1H_2O$	0·8 ,,	(0·5) †	$MgSO_4,4—5H_2O$	8·8 ,,	
$ZnSO_4,6—7H_2O$	13·6 ,,		$MgSO_4,1—4H_2O$	4·9 ,,	
$ZnSO_4,1—6H_2O$	12·8 ,,		$MgSO_4,0—1H_2O$	1·0 ,,	(0·5) †
$ZnSO_4,0—1H_2O$	1·0 ,,	(0·5) †	CaO,H_2O	0·8 ,,	

* Foote and Scholes, *J. Amer. Chem. Soc.*, 1911, **33**, 1324.

† Müller-Erzbach, *Ber.*, 1881, **14**, 1093, and *Zeitsch. physikal. Chem.*, 1888, **2**, 113.

The vapour pressures of all three monohydrates are very low, and not known very accurately, but they are probably near to that of calcium hydroxide. In all other cases where the dehydration is complete, using calcium carbide, the vapour pressure of the lowest hydrate is higher than that of calcium hydroxide.

The use of phosphoric oxide involves the production of phosphoric acid, and hence secondary reactions frequently occur. In the case of barium chloride the acid reacts with the anhydrous salt, giving a regular stream of hydrogen chloride. This seems to furnish a simple method of preparing fairly pure dry hydrogen chloride. It may be easily done by mixing powdered crystals of barium chloride with phosphoric oxide in a test-tube. In a few minutes hydrogen chloride is evolved, the rate depending on the intimacy of the mixture.

* It is well known that copper sulphate can be completely dehydrated at 50° by concentrated sulphuric acid.

246. "The diphenylcarbamyloximes." (Preliminary note.) By Frederick Percy Dunn.

The diphenylcarbamyloximes of benzaldehyde and the three nitrobenzaldehydes have been prepared by heating equivalent quantities of diphenylcarbamyl chloride and the sodium salts of the "*anti*"-oximes in dry chloroform or ether. It was found that the same compound was obtained by condensing diphenylcarbamyl chloride with the sodium salt of benz*anti*aldoxime as with that of benz*syn*aldoxime, either by heating or more slowly at the ordinary temperature. Treatment with alcoholic potassium hydroxide gave diphenylamine and benzonitrile, this result showing that the diphenylcarbamyloxime is a "*syn*" derivative (compare Hantzsch, *Ber.*, 1891, **24**, 17):

$$\begin{matrix} C_6H_5\cdot CH \\ \| \\ N\cdot O\cdot CO\cdot N(C_6H_5)_2 \end{matrix} \longrightarrow \begin{matrix} C_6H_5\cdot C \\ \| \\ N \end{matrix} + CO_2 + HN(C_6H_5)_2.$$

The syn-*diphenylcarbamyloxime* of benzaldehyde crystallises in colourless, flat needles, decomposing at 163° (Maquenne block). The three diphenylcarbamyloximes of the nitrobenzaldehydes decompose about the same temperature, and all become yellow on exposure to light. As it was found that the sodium salt prepared from *o*-nitrobenz*syn*aldoxime was mainly an "*anti*"-salt, the further investigation of the diphenylcarbamyloximes has been postponed in order to study the metallic salts of the oximes. The author also hopes to prepare the carbamyloximes and the phenylcarbamyloximes.

247. "Some reactions of phenyl *iso*propyl ketone." By Arthur Lapworth and Victor Steele.

As *iso*butyryl chloride is difficult to obtain quite free from propionyl chloride, phenyl *iso*propyl ketone, prepared by the Friedel-Crafts' reaction, is liable to be contaminated with phenyl ethyl ketone, which may be detected by the formation of β-ketonic esters when the ketone is treated with oxalic, formic, phthalic, and other esters in presence of sodium or sodium ethoxide; the pure ketone does not react at all with these esters.

Phenyl *iso*propyl ketoxime, which may be used in purifying the ketone, melts at 94°, and appears to exist in one form only, although previous observers have recorded 58° and 61° respectively as the melting point of the compound.

Whilst inert towards carboxylic esters, phenyl *iso*propyl ketone is acted on by amyl nitrite in the presence of alcoholic sodium ethoxide, yielding acetoxime, ethyl benzoate, and sodium benzoate,

the latter doubtless being formed as the result of the presence of water in the alcohol used.

248. "A new stereoisomeride of cyanodihydrocarvone." By Arthur Lapworth and Victor Steele.

d-Carvone unites with hydrogen cyanide in hot alcoholic solution and in the presence of potassium cyanide, yielding a product isomeric with the nitrile obtained at the ordinary temperature (*Trans.*, 1906, **89**, 945 and 1819). It melts at 84°, and has $[\alpha]_D^{11} - 42{\cdot}1°$ in absolute alcohol; it shows mutarotation in presence of bases, but the equilibrium point attained corresponds with a rotatory power quite different from that reached by the cyanodihydrocarvone first discovered. As both compounds yield pure *d*-carvone on removal of hydrogen cyanide, the existence of four isomeric nitriles derived from *d*-carvone is indicated by these facts, this number corresponding with that theoretically possible.

249. "The action of hydrogen cyanide on carvone hydrosulphide." By Victor Steele.

Many ketones which contain an ethylenic linking in the $\alpha\beta$-position do not form simple cyanohydrins, but first yield saturated β-cyanoketones, which may subsequently be converted, by union with hydrogen cyanide, into hydroxydicyano-compounds.

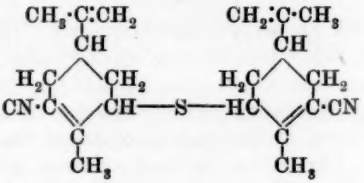
It was thought possible that in certain cases a cyanohydrin of the $\alpha\beta$-hydrochloride might be prepared, from which, by hydrolysis and subsequent removal of the elements of hydrogen chloride, the required unsaturated hydroxy-acid might be obtained. As these operations were not found possible, an analogous series of reactions, involving the use of hydrogen sulphide instead of hydrogen chloride, was examined.

The additive compound of hydrogen sulphide with carvone (Varrentrap, *Handworterbuch d. Chemie*, **4**, 688; Kekulé and Fleischer, *Ber.*, 1873, **6**, 1088) was mixed with one and a-half times its weight of alcohol and two molecular proportions of potassium cyanide dissolved in water, glacial acetic acid being subsequently added until the whole remained but slightly alkaline. To facilitate interaction, 30 c.c. of ether were then added, and the whole left in a corked flask four days at room temperature, when an equal bulk of water was added, and the ethereal solution separated, washed, dried, and evaporated. The residue formed a mass of needles, and was purified by crystallisation from alcohol:

0·1972 gave 0·5422 CO_2 and 0·1414 H_2O. C = 75·0; H = 8·0.
0·1704 „ 11·7 c.c. N_2 (moist) at 14° and 760 mm. N = 8·08.
0·2505 „ 0·1657 $BaSO_4$. S = 9·1.

$C_{22}H_{28}N_2S$ requires C = 75·0; H = 8·0; N = 7·95; S = 9·09 per cent.

The compound has therefore been produced by the elimination of the elements of water from the cyanohydrin first formed, and the following formula may therefore be assigned to it:



The compound dissolves fairly readily in the usual solvent media, with the exception of light petroleum, carbon disulphide, and water; it crystallises from alcohol in flat needles, which melt sharply at 94°. It at once discharges the colour of a solution of bromine in chloroform or of potassium permanganate in acetone:

0·4062, made up to 25 c.c. with absolute alcohol, gave, in a 2-dcm. tube, α + 0·16°, whence $[\alpha]_D^{12}$ + 4·92°.

In accordance with the absence of hydroxyl groups, the compound is not altered by acetic anhydride or chloride. It readily loses both hydrogen cyanide and hydrogen sulphide when heated with ferrous hydroxide and alkali, but is stable in the cold.

When titrated with a standard solution of bromine in acetic acid in presence of sodium acetate, 0·5 gram used up 0·465 gram of bromine instantaneously, corresponding with 4 atomic proportions of bromine; an additional 0·465 gram was absorbed in the course of thirty minutes, corresponding with a total quantity of 8 atomic proportions of bromine.

The new *dinitrile* is partly hydrolysed when heated for three hours with saturated hydrobromic acid, and an acid product, apparently a mixture, is obtained, contaminated with a neutral oil. The acidic portion of the product finally yielded a small quantity of an apparently pure compound, which melted sharply at 125°:

0·1940 gave 0·4770 CO_2 and 0·1443 H_2O. C = 67·1; H = 8·2.
$(C_{10}H_{14}\cdot CO_2H)_2S$ requires C = 67·7; H = 7·7 per cent.

0·1438 gram required 7·4 c.c. *N*/10-NaOH for complete neutralisation with phenolphthalein as indicator, whence the equivalent is 194; the value calculated for a dibasic acid, $(C_{10}H_{14}\cdot CO_2H)_2S$, is 195.

The acid is readily soluble in most of the usual media, with the

exception of water, carbon disulphide, and light petroleum. It decomposes if heated for a considerable time at 100°, giving a neutral, dark-coloured oil.

250. "Preparation of the nitrites of the primary, secondary, and tertiary ammonium bases." (Preliminary note.) By Pañchānan Neogi.

Small quantities of benzylammonium nitrite (Rây and Datta, *Trans.*, 1911, **99**, 1475), piperidinium nitrite (Neogi, *ibid.*, p. 1599), and triethylammonium nitrite (Neogi, *ibid.*, p. 1253) have been obtained by the distillation and sublimation in a vacuum of a concentrated solution of the hydrochlorides of the bases and the alkali nitrites. The actual isolation of these nitrites from the mixtures leads the author to believe that the reaction between nitrous acid and the primary, secondary, and tertiary amines proceeds through the intermediate stage of a nitrite, which decomposes, in the case of a primary amine to alcohol, in the case of a secondary amine to a nitroso-compound, and in the case of a tertiary amine to the original amine.

251. "Studies of ammonium solutions. Part I. An ammonium electrode." By Roland Edgar Slade.

When hydrogen containing ammonia is passed over platinised platinum in a solution containing ammonium ions, the platinum behaves as an ammonium electrode. The potential of this electrode at 25° depends on the partial pressures of hydrogen and ammonia and on the concentration of ammonium ions in the solution in the following way:

$$e = -0{\cdot}486 - 0{\cdot}059 \log \frac{p_{NH_3}\, p_{H_2}}{[NH_4^{\cdot}]},$$

where $e = e_{\text{electrode}} - e_{\text{solution}}$, and the potential of the normal hydrogen electrode is taken as zero.

Complexes of the form $(NH_3)_xH^{\cdot}$, where x is greater than one, do not exist to any appreciable extent in dilute aqueous ammonia or ammoniacal ammonium chloride solutions, although there is some evidence of their existence at higher concentrations.

252. "The absorption spectra of triketohydrindene hydrate and certain derivatives." By John Edward Purvis.

The results of an investigation of the absorption spectra of triketohydrindene hydrate and its derivatives showed that (1) the

colour of the compounds is intimately connected with the presence of ketonic groups; (2) the shade of colour is modified according to the nature of the substituting groups; (3) where another ring is established, there is no selective absorption, and the colour is produced by an extension of the general absorption within the regions of the visible spectrum.

253. "The action of chlorine on alkalis and of carbon dioxide on bleaching powder." By Robert Llewellyn Taylor.

In reply to Higgins' suggestion (*Trans.*, 1911, **99**, 858) that the increased bleaching efficiency of a solution of bleaching powder on the removal of free lime or the addition of chlorides (Taylor, *Trans.*, 1910, **97**, 2541) is not due to the reversal of the action and consequent liberation of chlorine, but, in the first case, to the further action of the carbon dioxide of the air, and, in the second case, to the increased attraction of such solutions for the carbon dioxide of the air, the author pointed out that most of his experiments were performed either in absence of air or with air from which the carbon dioxide had been removed, and described further experiments performed in closed vessels, in which he obtained similar results.

Higgins further stated that other neutral salts of sodium had a similar stimulating effect on the bleaching action of a solution of sodium hypochlorite to the chloride.

Further experiments by the author show that if a solution of sodium hypochlorite contains considerable excess of free alkali, its bleaching action is very slow, and it is not much stimulated by the addition of any sodium salts, but if there is not much free alkali present the stimulating action of sodium chloride is much greater than that of other neutral sodium salts.

The author further pointed out that Higgins' suggested explanation of the action of carbon dioxide on bleaching powder is not really very different from his own. Higgins represents the action by two equations, and the author by three, the second and third of the latter being merely a simplification of Higgins' second.

254. "The relation between residual affinity and chemical constitution. Part II. Certain compounds of nitrogen." By Hans Thacher Clarke.

An account was given of a study of the reactivity towards alcoholic benzyl chloride under standard conditions, and the refractive power of a series of open-chain and cyclic tertiary amines

containing one and two nitrogen atoms in the molecule. The conclusion was put forward that derivatives of piperazine display abnormal reactivity and refractive power when compared with the corresponding open-chain compounds. In a series of derivatives of piperidine, it was shown that the reactivity increased similarly when the nitrogen atoms were present in the 1:5-position in a normal chain.

255. "Theory of dyeing: colour and molecular state of picric acid." By William Porter Dreaper.

Picric acid in the anhydrous state is probably colourless. In the presence of moisture it is yellow, and possibly then has a quinonoid structure. In continuation of a previous investigation into the relative inhibiting action of fibre colloids on this colour change (Dreaper and Stokes, *J. Soc. Dyers*, 1909, **25**, 10), the action of toluene on picric acid when present within the fibre area has been examined.

The experimental results indicate that even in the case of cotton, although the change to the colourless type takes place readily in the presence of dehydrating agents, yet the presence of toluene will not bring about this change, in spite of the known fact that picric acid has little affinity for vegetable fibres in the presence of water; also, that under certain conditions picric acid in the yellow state will be adsorbed by cotton from a colourless toluene solution.

256. "Electromotive forces in alcohol. Part II. The hydrogen electrode in alcohol and the influence of water on its electromotive force." By Robert Taylor Hardman and Arthur Lapworth.

Concentration cells reversible to hydrogen ions with solutions of hydrogen chloride in absolute alcohol gave potentials which were constant and reproducible within a fraction of a millivolt. Results with solutions not weaker than $N/20$ were in fairly good agreement with those calculated by employing the transport numbers deduced in Part I (*Trans.*, 1911, **99**, 1420); with lower concentrations, discrepancies of several millivolts were found.

Water depresses the potential of the hydrogen electrode in alcoholic hydrogen chloride, and when the acid is dilute the results indicate a fall in the concentration of the "free" hydrogen ions which is very close to that anticipated on the assumption that the availability of the acid is a measure of this concentration as well as of

the catalytic activity of the cations of the acid in a given solvent (*Trans.*, 1908, **93**, 2168, 2190 *et seq.*; 1910, **97**, 23).

With *N*/100-hydrochloric acid in both compartments of such a concentration cell, the potentials observed when water is added to one compartment indicated a "water value" for absolute alcohol = 0·132 at 25°; with *N*/500-hydrochloric acid and *N*/10-lithium chloride to minimise potential differences at the liquid boundary, the "water value" indicated was 0·122 at 25°. These numbers are intermediate between those previously deduced from (i) measurements of the catalytic and (ii) the salt-forming activity of hydrogen chloride in absolute alcohol by Goldschmidt and Udby (0·15) and by Lapworth and Partington (0·10) respectively.

257. "Notes on new coumarin derivatives." By Arthur Clayton.

In view of the characteristic odour of the 5-nitro-substituted coumarins (Clayton, *Trans.*, 1910, **97**, 1388), the author attempted to prepare 5-nitrocoumarin, since its odour might reasonably be supposed to be stronger than that of the foregoing compounds.

A study of the action of nitric acid on the homologues of coumarin indicated a tendency for the nitro-group to enter position 5 when position 6 is already occupied by a substituent, whence it was hoped that 6-aminocoumarin would yield 5-nitro-6-aminocoumarin when nitrated, and that the amino-group could be subsequently removed by the diazo-reaction.

Preliminary experiments showed that 6-aminocoumarin yielded an unworkable tar when treated with nitric acid, either alone or in solution in acetic or sulphuric acid, but 6-acetylaminocoumarin, when dissolved in nitric acid (D 1·5) cooled to 10°, yielded a solution which, on dilution with water, furnished an abundant and almost white solid. The *nitro-6-acetylaminocoumarin* so obtained crystallised from glacial acetic acid in pale yellow needles, melting at 222—223°:

0·1452 gave 0·2828 CO_2 and 0·0590 H_2O. C = 53·10; H = 4·52.
0·1438 „ 15·1 c.c. N_2 at 21° and 742 mm. N = 11·67.
$C_{11}H_8O_5N_2$ requires C = 53·23; H = 3·23; N = 11·29 per cent.

Nitro-6-acetylaminocoumarin proved to be easily hydrolysed by boiling with sulphuric acid diluted with three times its volume of water for thirty minutes. The product, *nitro-6-aminocoumarin*, was obtained by further dilution with water, and was then crystallised from glacial acetic acid, when orange needles, melting at 238—240°, were obtained:

0·1182 gave 0·2266 CO_2 and 0·0354 H_2O. C = 52·31; H = 3·36.
0·1432 „ 17·5 c.c. N_2 at 21° and 742 mm. N = 13·58.
$C_9H_6O_4N_2$ requires C = 52·43; H = 2·91; N = 13·59 per cent.

All attempts to eliminate the amino-group from the foregoing compound proved unsuccessful, owing to the extreme ease with which *coumarin-6-diazo-5-oxide* is formed. The latter compound is produced in greatest quantity when nitro-6-aminocoumarin (1 gram) is mixed with absolute alcohol (10 c.c.), and concentrated sulphuric acid (4 to six drops) and an excess of amyl nitrite are consecutively added. On warming, the mixture becomes less pasty, and then, rather suddenly, a mass of crystals is deposited. This product was separated and crystallised from very dilute alcohol, when yellow needles were obtained, melting with abrupt decomposition at 155—160°. It yields no definite product when boiled with acids or alkalis:

0·1468 gave 0·3076 CO_2 and 0·0307 H_2O. C = 57·14; H = 2·32.
0·1203 „ 15·0 c.c. N_2 at 18° and 770 mm. N = 14·60.
$C_9H_4O_3N_2$ requires C = 57·45; H = 2·13; N = 14·89 per cent.

During experiments performed in other directions with the hope of obtaining odorous nitrocoumarins, the following compounds were also obtained.

6-*Methylcoumarin* was prepared by heating together 2-hydroxy-*m*-tolualdehyde (3 grams), anhydrous sodium acetate (3 grams), and acetic anhydride (5 grams) in an oil-bath at 180° for four hours. The product solidified to a brown cake on cooling. This was boiled with water to remove the sodium acetate, and the residue from the cold liquid ground up with methyl alcohol (2 to 3 c.c.). The filtered product was then crystallised, first from dilute methyl alcohol and then from petroleum, after which it formed white needles, melting at 75°. These crystals are somewhat soluble in water, and possess an odour of coumarin:

0·1083 gave 0·2983 CO_2 and 0·0520 H_2O. C = 75·11; H = 5·34.
$C_{10}H_8O_2$ requires C = 75·00; H = 5·00 per cent.

Nitro-6-methylcoumarin was obtained by dissolving 6-methylcoumarin in concentrated sulphuric acid (20 parts), and adding nitric acid (1 molecule). After twenty minutes, the liquid was poured on ice, and the precipitated solid crystallised from alcohol, when white, inodorous needles, melting at 147—148°, separated:

0·1576 gave 9·6 c.c. N_2 at 23° and 766 mm. N = 6·92.
$C_{10}H_7O_4N$ requires N = 6·83 per cent.

4: 8-*Dimethyl*-6-tert.-*butylcoumarin*.—This compound resulted from the condensation of equimolecular quantities of *p-tert.*-butyl-*o*-cresol and ethyl acetoacetate in the presence of concentrated

sulphuric acid. White, inodorous needles were obtained, melting at 159—160°:

0·1980 gave 0·5664 CO_2 and 0·1422 H_2O. C = 78·03; H = 7·98.

$C_{15}H_{18}O_2$ requires C = 78·26; H = 7·83 per cent.

The substance appears to behave abnormally toward nitric acid, owing probably to the presence of the *tert.*-butyl group. The nitration product forms white needles, melting at 240—241°, and possesses a pleasant but not very marked odour.

258. "The temperature-coefficient of the electrical conductivity of hydrogen chloride in alcoholic solution." By James Riddick Partington.

The experiments proposed in a former communication (Lapworth and Partington, *Trans.*, 1911, **99**, 1426) are now completed, and the conductivities of alcoholic hydrogen chloride at 0°, 18°, and 25° have been determined.

The values at infinite dilution are found to be:

λ_∞ at 0° = 46·50,
λ_∞ at 18° = 60·00,
λ_∞ at 25° = 66·50.

From these the mean value of the temperature-coefficient, α_∞, is found to be 0·0178 units of λ_∞ at 0° per 1°, and is therefore normal.

259. "The constituents of the oil of Pinus longifolia." By Henry Haliburton Robinson.

By fractional distillation, the oil of *Pinus longifolia* was found to be divisible into two portions; one portion, amounting to about one-third of the whole, was of a much lower boiling point than the other, and was found to be *l*-pinene. The remaining two-thirds was mainly composed of an oil boiling at 173°, having D_{15}^{15} 0·867 and α_D about +13°. From this, by treatment with dry hydrogen chloride, sylvestrene dihydrochloride was obtained, from which sylvestrene was regenerated. From the mother liquors left after removing as far as possible the sylvestrene dihydrochloride, dipentene was obtained. It is thought very possible that the sylvestrene is not present as such in the original oil, but that a terpene is there contained, which unites with hydrogen chloride to form sylvestrene dihydrochloride, just as pinene yields a hydrochloride from which camphene is obtained when the hydrogen chloride is removed.

260. "The active constituents of the Indian solanaceous plants: Datura Stramonium, D. fastuosa, and D. Metel." By Albert Edward Andrews.

It was found that in the Indian *Datura Stramonium* plants the percentage of total alkaloid in the stems was 0·25; in the leaves, 0·41 to 0·45; and in the fruits, 0·46 per cent.; with one exception this alkaloid consisted of hyoscyamine either alone or associated with a small proportion of scopolamine. The results indicate that the Indian plant bears favourable comparison with the European and Egyptian plants as regards the amount of total alkaloid, but the presence of scopolamine in some of the Indian samples appears to be a point of difference.

In the Indian *Datura fastuosa* samples, the total alkaloid varied from 0·1 in the roots to 0·2 in the fruits, and scopolamine was found to be the predominant alkaloid. In these respects the Indian plant closely resembles the European plant.

In the Indian *Datura Metel* samples the seeds and the leaves contained 0·25, and the capsules 0·12 per cent., of total alkaloid. On comparing the results with those recorded for the European species it appears that in the Indian plant the amount of total alkaloid in the seeds and in the leaves is only about one-half what it is in the European plant, but with one exception the samples resemble the latter in so far that scopolamine is almost unaccompanied by other mydriatic alkaloids.

261. "Contributions to the chemistry of the terpenes. Part X. The action of chromyl chloride, nitrous acid, and nitric acid on bornylene." By George Gerald Henderson and Isidor Morris Heilbron.

On treatment with chromyl chloride dissolved in carbon disulphide, bornylene is converted into a solid *additive product*, $C_{10}H_{16},2CrO_2Cl_2$, which is decomposed by water, giving a *chloroketone*, $C_{10}H_{15}OCl$, and an aldehyde, $C_9H_{15}\cdot CHO$. The ketone, a crystalline solid, m. p. 165°, gives a *semicarbazone*, melting at 234—235°, and yields camphoric acid when oxidised with potassium permanganate, and camphor when heated with alcoholic potassium hydroxide under pressure. It therefore appears to be a new *chlorocamphor*. The aldehyde was proved to be camphenilanaldehyde, a derivative of camphene, which has been prepared in several different ways from that hydrocarbon. The direct formation of this camphene derivative from bornylene indicates close similarity in the molecular structure of these terpenes.

It has been observed that camphenilanic acid, $C_9H_{15}\cdot CO_2H$, can be converted into *iso*camphenilanic acid by repeated crystallisation from water, alcohol, or light petroleum, and also that the semicarbazones obtained from camphenilanaldehyde and *iso*camphenilanaldehyde respectively are identical, and that each yields the *iso*-aldehyde when decomposed with dilute acids.

Bromoisocamphenilanic acid, a crystalline solid, m. p. 204—205°, was prepared by converting *iso*camphenilanic acid into its *chloride*, $C_9H_{15}\cdot COCl$, a dense liquid, b. p. 118°/25 mm., heating this with bromine under pressure, and decomposing the *chloride* of the *bromo-acid*, $C_9H_{14}Br\cdot COCl$, which is also a heavy, viscous liquid, with water. When warmed with aqueous sodium carbonate, the bromo-acid does not give a corresponding hydroxy-acid, but is converted into an unsaturated acid, $C_9H_{13}\cdot CO_2H$, a colourless, crystalline solid, m. p. 147°.

Bornylene shows a general resemblance to camphene in its behaviour towards nitrous acid, but different products are obtained on attacking these terpenes with nitric acid.

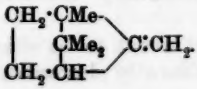
On treatment with nitrous acid, bornylene yields (1) a nitrosite, $(C_{10}H_{16}\cdot N_2O_3)_2$, which crystallises in silky needles, m. p. 163°, and yields camphoric acid on oxidation; (2) an oily, green liquid, which decomposes when heated, dissolves in solutions of alkalis, and is probably an *isonitrosite*; (3) some camphorquinone; and (4) a very small quantity of a colourless, crystalline *compound*, m. p. 84—85°, which is possibly a nitrite.

When heated with nitric acid, bornylene is, for the most part, oxidised to camphoric acid, but some of it is converted into a yellow, crystalline compound, m. p. 137°, which has the formula $C_{10}H_{16}(NO_2)_2$, and appears to be *dinitrocamphane*. On reduction with alcoholic ammonium sulphide, this substance yields a *compound* which crystallises in yellow needles, m. p. 196—198°, and which apparently is not an amino-derivative. A trace of a colourless, crystalline *compound*, m. p. about 174°, was also found among the oxidation products.

262. "The constitution of camphene."

By George Gerald Henderson and Isidor Morris Heilbron.

Arguments were adduced in support of the view that the constitution of camphene is best represented by the formula:



263. "Candelilla wax." By James McConnell Sanders.

A sample of Candelilla wax, prepared in the month of January from plants collected in Coahuila, had the appearance of a greenish-white mass with a granular fracture. It contained a considerable proportion of water, and when freed from this, was dark brown, and gave the following values:

Melting point	67·5°
Density.....	0·9850
Acid value	14·39
Saponification value	46·76
Iodine value (Hübl)	16·60 per cent.
Unsaponifiable matter	77·00 ,,
Hydrocarbons	48·60 ,,

The wax contained hentriacontane and myricyl alcohol.

264. "A convenient method for determining the density of heavy petroleums." By James McConnell Sanders.

Heavy crude petroleums and derived products of similar character, such as the more viscous lubricants, "black oils," etc., present difficulties in manipulation when the determination of their density at the standard temperature is attempted by the usual procedure. In the absence of a knowledge of the coefficient of expansion of a particular sample, it is always desirable to determine the density at a temperature as close to the normal air temperature as possible, this being the more desirable when the data to be obtained are subsequently to be utilised for calculation with large volumes of the commercial article.

Crude petroleums are often so dense and viscous that a determination of the density with the pyknometer is very troublesome, and a very appreciable error is introduced by the presence of suspended water, which cannot be removed easily without employing means which are liable materially to modify the density of the oil.

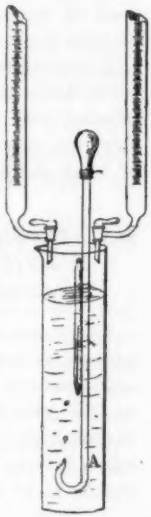
Filtering through hot anhydrous sodium sulphate, or dry salt, usually results in the loss of the more volatile components of the oil, and the use of the filter pump to facilitate filtration in the cold often gives rise to the same source of error. With increasing density and viscosity of an oil, there is increased difficulty of manipulation and simultaneously increased error from included water.

In the simple method about to be described, the error from suspended water is considerably decreased, although not entirely

removed; at the same time, the method possesses the advantage of rapidity and economy in the amount of sample employed.

The necessary apparatus consists of a curved glass tube of the form shown, provided with a small rubber bulb or a rubber tube with a pinchcock, according to the density of the oil to be examined. In addition, two graduated burettes of 100 c.c. capacity, a cylinder capable of containing 100 c.c., a thermometer, and a rubber-tipped glass rod.

Two solutions of alcohol and water are required, one containing 0·5 per cent. of alcohol, the other 75 per cent., both by volume. These solutions should be prepared beforehand, and preserved in stoppered stock bottles. The alcohol used should be pure, and the water free from air.



The following method of procedure is to be followed. A well-mixed and representative sample of the oil is poured into the curved glass tube so as nearly to fill it; if the oil is very viscous the small, rubber, pear-shaped cap is used to close the upper orifice of the tube, otherwise the tube and pinchcock are employed.

The burettes are then filled each with one of the alcoholic mixtures, the level of the liquids being brought to the zero point on the burettes, and these are then supported one on each side of the glass cylinder.

The thermometer is then fastened to the filled glass tube in such a manner that its bulb will occupy the central zone of the cylinder when the tube is placed within it so as to rest on the bottom.

About 75 c.c. of the more dilute alcohol are then run into the cylinder from the burette, and the glass tube is immersed in the cylinder. By means of the pinchcock or rubber bulb, a single small drop of the oil is expelled from the lower orifice of the tube, when, if the density of the liquid is greater than that of the oil drop, it will immediately rise to the surface, and can be "fished out" by touching it with the rubber-tipped glass rod. A little of the stronger alcohol is then run in from the other burette, and another trial drop of oil expelled; these operations are repeated until the trial drops begin to rise more slowly and assume a spherical form, showing that the density of the alcohol mixture is approaching that of the oil. When this point is reached, the oil drops should be allowed to exude more slowly, so as to allow any suspended water

to be dissolved out by the alcohol, and also to allow the temperature of the alcoholic mixture to coincide with that of the oil in the tube. With a little practice, it is possible to procure a number of oil drops floating in various zones of the alcoholic mixture, when the latter should be well stirred, using the tube and attached thermometer for the purpose. As soon as the densities of the mixture and the oil drops are identical, the volumes of the two alcohols used to form the mixture are read off from the burettes, and the density of the mixture is calculated from the amounts used.

Instead of calculating the density of the mixture (which assumes a previous determination of the density of each dilute alcohol), the mixture may be filtered quickly through moistened cotton wool to separate the oil drops, and the density taken with the hydrometer or the Westphal balance.

A convenient practice consists in preserving the alcoholic mixtures obtained in a series of experiments in closely stoppered bottles, labelled with the corresponding densities and temperatures. These empirical solutions can then be used for approximate determinations of fresh samples of oil.

265. "The probable cause of the elimination of a carbethoxyl group as ethyl carbonate by the action of sodium ethoxide." By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

The cause of the elimination of a carbethoxy-group during the passage of an open-chain nitrile carboxylic ester into a five-ring imino-compound is not due to any condition of strain consequent on the presence of more than one carbethoxy-group on any one carbon atom of the ring, but must be ascribed to a tendency which exists for the compound to acquire the hydrogen atom necessary to enable it to react in its tautomeric form.

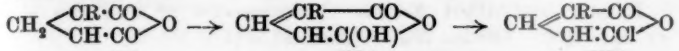
266. "The chemistry of the glutaconic acids. Part II. The reactions of the alkylglutaconic acids having one mobile hydrogen atom." By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

The experiments which have been carried out lead to the following conclusions:

(1) The α-monosubstituted derivatives of glutaconic acid are stable in their *trans*-forms, but can be isolated as unstable *cis*-modifications.

(2) The stability of the *cis*-modifications increases with the weight of the group occupying the α-position.

(3) The tendency for the mobile hydrogen atom to pass outside the three-carbon system is manifested as soon as ring formation is produced from the *cis*-modification. Thus, the normal anhydride (I) is converted into the hydroxy-anhydride (II) on distillation, and this is transformed into the chloro-anhydride (III) by acetyl chloride:



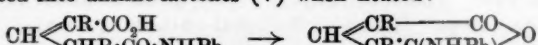
(I.) (II.) (III.)

(4) The anilic acids of the *cis*-modifications pass into the anilic acids of the *trans*-forms when heated.

(5) The di- and tri-substituted derivatives are stable as their *cis*-forms, and cannot be isolated as *trans*-modifications.

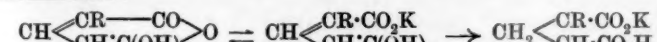
(6) The tendency for the mobile hydrogen atom to pass outside the three-carbon system diminishes with the increase of alkyl groups in the molecule.

(7) The presence of the mobile hydrogen is indicated, not only by the formation of hydroxy-anhydrides and chloro-anhydrides, but also by the behaviour of the anilic acids (IV), which are converted into anilino-lactones (V) when heated:



(IV.) (V.)

(8) The stability of the form which has the hydrogen atom outside the three-carbon system is shown by the fact that the more stable hydroxy-anhydrides behave on titration as monobasic acids, and can be recovered from the solution on acidifying. Analysis of the salts shows them to possess the constitution (VI). It is only when the neutral solution is warmed that the hydrogen passes back into the three-carbon system, yielding the alkali salt of the *cis*-modification:



(VI.)

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Avogadro, *Amedeo.* Opere scelte. Pubblicate dalla R. Accademia delle Scienze di Torino. pp. cxl + 491. Portrait. Torino 1911. (*Reference.*) From the Academy.

Backer, *Hilmar Johannes.* De Nitraminen en hunne electrochemische reductie tot Hydrazinen. pp. xv + 242. Leiden 1911. (*Recd.* 6/7/11.) From the Author.

Cross, *Charles Frederick,* **Bevan,** *Edward John,* **Sindall,** *Robert Walter,* and **Bacon,** *William N.* Wood pulp and its uses. pp. xi + 270. ill. London 1911. (*Recd.* 19/7/11.) From the Authors.

Friend, *John Albert Newton.* The corrosion of iron and steel. pp. xiv + 300. London 1911. (*Recd.* 27/7/11.)
From the Publishers: Messrs. Longmans, Green and Co.

Graebe, *Carl.* Untersuchungen über Chinone. Edited by *Herman* **Decker.** pp. viii + 672. Portraits. Leipzig 1911. (*Reference.*)
From the Author.

Jago, *William,* and **Jago,** *William C.* The technology of bread-making. Including the chemistry and analytical and practical testing of wheat, flour, and other materials employed in bread-making and confectionery. pp. viii + 908. ill. London 1911. (*Recd.* 28/9/11.)
From the Authors.

Knecht, *Edmund,* **Rawson,** *Christopher,* and **Loewenthal,** *Richard.* A manual of dyeing. 2nd edition. 2 vols. pp. xii + 902. ill. London 1910. (*Recd.* 6/7/11.) From Professor E. Knecht.

Lunge, *George.* [Editor.] Technical methods of chemical analysis. English translation from the latest German edition, adapted to English conditions of manufacture, edited by *Charles Alexander* **Keane.** Vol. II, in two parts. pp. xxvii + 1252. ill. London 1911. (*Recd.* 14/10/11.) From Dr. Charles A. Keane.

Mastin, *John.* The chemistry, properties and tests of precious stones. pp. vi + 114. London 1911. (*Recd.* 14/10/11.)
From the Author.

Mennicke, *Hans.* Die Metallurgie des Wolframs mit besonderer Berücksichtigung der Elektrometallurgie sowie der Verbindungen und Legierungen des Wolframs samt seinen Verwendungen. pp. ii + 416. ill. Berlin 1911. (*Recd.* 11/10/11.)
From the Publisher: M. Krayn.

Menschutkin, *Boris N.* Life and work of N. A. Menschutkin. pp. viii + 376. ill. 1908. [In Russian.] (*Recd.* 21/7/11.)
From Sir William Tilden, F.R.S.

Partington, *J. Riddick.* Higher mathematics for chemical students. pp. iv + 272. London 1911. (*Recd.* 27/7/11.)
From the Publishers: Messrs. Methuen & Co.

Roscoe, *The Right Honourable Sir Henry Enfield,* and **Schorlemmer,** *Carl.* A treatise on chemistry. Vol. I. The non-metallic elements. New edition completely revised by *Sir H. E.* **Roscoe,** assisted by *J. C.* **Cain.** pp. xii + 955. ill. London 1911. (*Reference.*)
From the Right Honourable Sir H. E. Roscoe, F.R.S.

Simmons, *William Herbert*, and **Mitchell,** *Charles Ainsworth.* Edible fats and oils. Their composition, manufacture and analysis. pp. viii + 150. London 1911. (*Recd.* 28/9/11.) From the Authors.

Spencer, *James Frederick.* An experimental course of physical chemistry. Part I. Statical experiments. pp. xiv + 228. ill. London 1911. (*Recd.* 29/9/11.) From the Author.

Zacharias, *Johannes.* Elektrochemische Umformer [Galvanische Elemente]. pp. xii + 262. ill. Wien 1911. (*Recd.* 12/10/11.) From the Publisher: A. Hartleben.

II. *By Purchase.*

Allen, *Alfred Henry.* Commercial organic analysis. Vol. V. 4th edition. Edited by *William Alfred* **Davis** and *Samuel S.* Sadtler. pp. ix + 704. London 1911. (*Recd.* 16/10/11.)

Chalon, *Paul F.* Les explosifs modernes. 3rd edition. pp. vi + 789. Paris 1911. (*Recd.* 19/7/11.)

Higgins, *William.* An essay on the theory and practice of bleaching, wherein the sulphuret of lime is recommended as a substitute for pot-ash. pp. xxxii + 71. London 1799. (*Recd.* 16/6/11.)

Scheithauer, *W.* Die Schwelteere, ihre Gewinnung und Verarbeitung. pp. viii + 192. Leipzig 1911. (*Recd.* 25/7/11.)

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 4th, 1911.

All persons who received grants in December, 1910, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Friday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

MARCELIN BERTHELOT MEMORIAL LECTURE.

An Extra Meeting will be held on Thursday, November 23rd, 1911, at 8.30 p.m., when the Berthelot Memorial Lecture will be delivered by Professor Harold B. Dixon, M.A., Ph.D., F.R.S.

ERRATA.

PROCEEDINGS, 1911.

Page	Line	
184	10	*after* "many" *insert* "other."
191	8*	*for* "β-5-hydroxy-3-methoxyphenylethylamine" *read* "β-5-hydroxy-3-methoxyphenylpropionic acid."

* From below.

At the next Ordinary Scientific Meeting on Thursday, November 2nd, 1911, at 8.30 p.m., the following papers will be communicated:

"The constituents of the seeds of *Casimiroa Edulis*." By F. B. Power and T. Callan.

"Preparation of the betaine of tryptophan, and its identity with the alkaloid hypaphorine." By P. von Romburgh and G. Barger.

"β-2-Methoxynaphthylpropionic acid and methoxy-*peri*-naphthindanone." By G. Barger and W. W. Starling.

"Dihydroxydihydrindylamine and its resolution into optically active components." By W. J. Pope and J. Read.

"Studies in phototropy and thermotropy. Part II. Naphthylideneamines." By A. Senier and R. Clarke.

"Some derivatives of 4-(or 5)-methylglyoxaline." By A. J. Ewins.

"The stability of the double oxalates of sodium and nickel, and sodium and cobalt." By J. W. Dodgson.

"The lower limit of inflammation of mixtures of the paraffin hydrocarbons with air." By M. J. Burgess and R. V. Wheeler.

R. CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.

[*Issued* 10/11/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 391.

Thursday, November 2nd, 1911, at 8.30 p.m., Dr. M. O. FORSTER, D.Sc., Ph.D., F.R.S., Vice-President, in the Chair.

Certificates were read for the first time in favour of Messrs.:

John Henry Garner, B.Sc., Sewage Works, Deighton, Huddersfield.
Rufus Gaunt, M.Sc., Ph.D., 70, Abingdon Villas, Kensington, W.
Sant Ram Khosla, near City Kotwali, Lahore, India.
Harold King, M.Sc., 161, Altmore Avenue, East Ham, E.
Geoffrey Martin, M.Sc., Ph.D., 4, Bertram Road, Hendon, N.W.
George Alfred Stokes, 60, Parkhill Road, Hampstead, N.W.

Of the following papers, those marked * were read:

***267. "The constituents of the seeds of Casimiroa edulis." By Frederick Belding Power and Thomas Callan.**

The material employed for this investigation consisted of the fresh seeds of *Casimiroa edulis*, La Llave and Lejarza (Nat. Ord. *Rutaceae*), which were obtained directly from Mexico.

The kernels of the seed, representing about four-fifths of the weight of the entire material, gave abundant reactions for an alkaloid, and were found to contain an enzyme which slowly hydrolysed amygdalin.

An alcoholic extract of the kernels, when distilled in a current of steam, yielded a small amount of a pale yellow essential oil, which possessed an aromatic odour and the following constants: D^{20} 0·9574; α_D −2°25′ in a 25 mm. tube.

From the portion of the extract which was soluble in water there were isolated: (1) a new alkaloid, *casimiroine*, $C_{24}H_{20}O_8N_2$ (m. p. 196—197°), which on heating with alkalis undergoes hydrolysis with the elimination of carbon dioxide, yielding a new base, *casimiroitine*, $C_{23}H_{22}O_7N_2$ (m. p. 171°); (2) a new alkaloid, *casimiroedine*, $C_{17}H_{24}O_5N_2$ (m. p. 222—223°); (3) benzoic acid, with apparently a trace of salicylic acid. The aqueous liquid contained, furthermore, a quantity of sugar, which yielded *d*-phenylglucosazone (m. p. 205—207°).

The portion of the extract which was insoluble in water consisted of a soft, oily resin, from which the following compounds were isolated: (1) sitosterol, $C_{27}H_{46}O$; (2) ipuranol, $C_{23}H_{38}O_2(OH)_2$; (3) a mixture of fatty acids; (4) a new lactone, *casimirolid*, $C_{24}H_{28}O_6$ (m. p. 229—230°), which yields a new hydroxy-acid, designated as *casimiroic acid*, $C_{23}H_{28}O_4(OH)\cdot CO_2H$ (m. p. 207°), of which the *silver* salt, *methyl* ester, and *acetyl* derivative were prepared; (5) a yellow, phenolic *substance*, $C_{16}H_{12}O_6$ (m. p. 215—218°).

The hypnotic or toxic properties attributed to *Casimiroa* seed could not be confirmed by physiological tests.

***268. "Preparation of the betaine of tryptophan and its identity with the alkaloid hypaphorine." By Pieter van Romburgh and George Barger.**

The betaine $C_{14}H_{18}O_2N_2$ has been obtained by the methylation of tryptophan, and has been proved to be identical with the naturally occurring alkaloid hypaphorine. The intermediate compound, $C_{15}H_{21}O_2N_2I$, which is formed is the quaternary *iodide* of *methyl α-trimethylamino-β-indolepropionate*, glistening plates, m. p. 197°.

***269. "β-2-Methoxynaphthylpropionic acid and methoxy*peri*naphthhydrindone." By George Barger and Walter William Starling.**

Experiments were carried out with the object of adding a third six-membered ring to naphthalene by introducing a chain of three carbon atoms joining two *peri*-positions (compare Sachs and Brigl, *Ber.*, 1911, **44**, 2091). The following new substances were described: *β-2-methoxynaphthylacrylic acid*,

$$CH_3\cdot O\cdot C_{10}H_6\cdot CH{:}CH\cdot CO_2H,$$

m. p. 160°; *β-2-methoxynaphthylpropionic acid*,

$$CH_3\cdot O\cdot C_{10}H_6\cdot CH_2\cdot CH_2\cdot CO_2H,$$

m. p. 128°; and *methoxyperinaphth-hydrindone*, $C_{14}H_{12}O_2$, deep yellow crystals, b. p. 210°/12 mm., m. p. 135°.

***270. "Some derivatives of 4(or 5)-methylglyoxaline." By Arthur James Ewins.**

By heating 4(or 5)-methylglyoxaline with formaldehyde to 120°, an additive product, 4(or 5)-*methyl*-5(or 4)-*hydroxymethylglyoxaline*, m. p. 138°, is formed. When treated with phosphoryl chloride, this compound yields 4(or 5)-*methyl*-5(or 4)-*chloromethylglyoxaline*. The latter can be converted into 4(or 5)-*methyl*-5(or 4)-*cyanomethylglyoxaline*, m. p. 163—164°, which on reduction yields 4(or 5)-*methyl*-5(or 4)-*β-aminoethylglyoxaline*, a new base which was found to be physiologically active, having a marked vaso-dilator effect.

By the action of ammonia and methylamine respectively on 4(or 5)-methyl-5(or 4)-chloromethylglyoxaline were obtained 4(or 5)-*methyl*-5(or 4)-*aminomethylglyoxaline* and 4(or 5)-*methyl*-5(or 4)-*methylaminomethylglyoxaline*. These compounds were, however, physiologically inactive.

***271. "Studies in the camphane series. Part XXX. Constitution of pernitrosocamphor (camphenylnitroamine)." By Martin Onslow Forster, John Robert Trotter, and Jacob Weintroube.**

From experiments with pernitrosocamphor and its potassium derivative, the authors were led to put forward new formulæ for these compounds.

272. "Dihydroxydihydrindamine and its resolution into optically active components." By William Jackson Pope and John Read.

Improved methods were described for the preparation of bromohydroxyhydrindene, $C_6H_4<\begin{matrix}CH_2\\CH(OH)\end{matrix}>CHBr$, and its conversion into *dihydroxydihydrindamine* (I) and 1-*hydroxy*-2-*hydrindamine* (II):

$$\left(C_6H_4<\begin{matrix}CH_2\\CH(OH)\end{matrix}>CH\right)_2NH \qquad C_6H_4<\begin{matrix}CH_2\\CH(OH)\end{matrix}>CH\cdot NH_2$$

(I.) (II.)

The resolution of dihydroxydihydrindamine into its optically active components by means of *d*-camphor-β-sulphonic acid was described.

273. "Studies in phototropy and thermotropy. Part II. Naphthylideneamines." By Alfred Senier and Rosalind Clarke.

The Schiff's bases obtained by the condensation of 2-hydroxy-α-naphthaldehyde with various aromatic amines have been studied in order to see if these compounds, which contain the hydroxyl radicle in the ortho-position with respect to the group ·CH:NR in the naphthalene ring, exhibit phototropy or thermotropy in the same manner as previous experience had shown to be the case with analogous benzene derivatives.

The naphthylideneamines in question are obtained by the interaction of 2-hydroxy-α-naphthaldehyde with the following amines: *o*-, *m*-, and *p*-chloroanilines, *o*-, *m*-, and *p*-bromoanilines, *m*-nitroaniline, *o*-, *m*-, and *p*-aminophenols, *o*-, *m*-, and *p*-anisidines, *o*-, *m*-, and *p*-aminobenzoic acids, *o*-4-, *m*-4-, and *p*-xylidines, and ψ-cumidine. None of these bases proved to be phototropic, but all exhibit thermotropy.

274. "The stability of the double oxalates of sodium and nickel, and sodium and cobalt." By John Wallis Dodgson.

On boiling nickel oxalate, $NiC_2O_4,2H_2O$, with an approximately 2*N*-solution of sodium carbonate, a green solution is obtained; when this is filtered from the residue, and allowed to remain for about twenty-four hours, green crystals separate, which consist of the double oxalate of sodium and nickel, with but a small amount of impurity. The green solution cannot be crystallised by evaporation aided by heat, as the salt is partly decomposed on heating with water or with sodium carbonate solution, forming a pale green precipitate, but leaving a solution still green in colour. The green solution is also obtained when sodium oxalate and nickel oxalate are boiled together with water, and also when nickel carbonate is boiled with sodium oxalate solution, but in the latter case crystals do not form easily.

Three specimens of the crystalline compound were prepared, one (*a*) by boiling 20 grams of nickel oxalate with 100 c.c. of a 2*N*-solution of sodium carbonate, another (*b*) by boiling 15 grams of nickel oxalate with 100 c.c. of a 4*N*-solution of sodium carbonate, and a third (*c*) by boiling sodium oxalate and nickel oxalate in molecular proportions with water. A green solution was obtained in each case; it was filtered, and allowed to remain for a few days, when the crystals separated, and were washed several times with cold water and dried in the air. On analysis:

(*a*) Found Ni = 13·68; Na = 10·41; C_2O_4 = 41·18; H_2O = 34·73.*
(*b*) „ Ni = 13·62; Na = 10·83; C_2O_4 = 41·18; H_2O = 34·37.*
(*c*) „ Ni = 13·77; Na = 10·79; C_2O_4 = 41·43; H_2O = 34·01.*
$Na_2C_2O_4,NiC_2O_4,8H_2O$ requires Ni = 13·82; Na = 10·83; C_2O_4 = 41·44; H_2O = 33·91 per cent.

The results agree sufficiently closely with one another to warrant the conclusion that the same compound is formed in each case, and that its composition is properly expressed by the formula

$$Na_2C_2O_4,NiC_2O_4,8H_2O.$$

In order to test the effect of a large excess of carbonate, 100 c.c. of a 4*N*-solution of sodium carbonate were boiled with three grams of nickel oxalate; a pale green solution was obtained, from which no crystals separated after five days; later sodium carbonate crystallised out, leaving the solution still green. This result agrees with that obtained on boiling the double oxalate with a solution of sodium carbonate.

The reaction which takes place is obviously a balanced reaction, and may be represented by the equation:

$$Na_2CO_3 + 2NiC_2O_4 \rightleftharpoons Na_2C_2O_4,NiC_2O_4 + NiCO_3,$$

the actual conditions of equilibrium depending on the relative masses of the sodium carbonate and nickel oxalate reacting.

As, however, the most interesting case is that of the action of a 2*N*-solution of sodium carbonate, 5 grams of nickel oxalate were boiled with 50 c.c. of 2*N*-sodium carbonate, the liquid filtered while hot, the residue thoroughly washed with successive quantities of cold water, and the filtrate and washings diluted to half a litre. Analysis showed that this contained 2·2 grams of C_2O_4 and 0·245 gram of nickel; these amounts are 87·5 per cent. of the C_2O_4, and 15·2 per cent. of the nickel in the nickel oxalate taken. The residue left on the filter was found to contain oxalate.

Cobalt oxalate, $CoC_2O_4,2H_2O$, is decomposed in a similar manner, but the amount of double oxalate produced is not so great. Five grams of cobalt oxalate were boiled with 50 c.c. of 2*N*-sodium carbonate, and filtered and washed. The filtrate was found to contain 2·37 grams of C_2O_4 and 0·117 gram of cobalt; in this case practically all the C_2O_4 in the original oxalate enters into solution, but only 7·3 per cent. of the cobalt, as compared with 15 per cent. of the nickel. The residue consisted entirely of carbonate.

The double oxalate of cobalt and sodium is easily prepared by boiling together cobalt oxalate and sodium oxalate with water. The pink solution deposits crystals on keeping, which on analysis gave the following result:

* By difference.

Found: Co = 13·89; C_2O_4 = 41·18.

$Na_2C_2O_4,CoC_2O_4,8H_2O$ requires Co = 13·88; C_2O_4 = 41·41 per cent.

It is therefore obvious that neither nickel oxalate nor cobalt oxalate can be completely converted into carbonate by the action of a sodium carbonate solution, and that in each case a soluble double oxalate is formed, having the composition given by the formulæ already deduced, this double salt being stable in the presence of excess of sodium oxalate.

275. "The lower limit of inflammation of mixtures of the paraffin hydrocarbons with air." By Maurice John Burgess and Richard Vernon Wheeler.

The conditions under which self-propagation of flame can take place in mixtures of inflammable gases and air were discussed. The authors find that the smallest quantity of pure methane that will enable self-propagation of flame to take place when a source of heat is introduced into a mixture of it with air is 5·6 per cent. by volume of the mixture. That is to say, the "lower-limit mixture" contains 5·6 per cent. of methane.

It was shown that for the paraffin hydrocarbons the lower limit of inflammation varies inversely as the calorific value of the gas. Thus, if L = the proportion of the paraffin hydrocarbon necessary to form a lower-limit mixture, and C = its calorific value,

$$L = f(1/c);\ \text{or, say, } L = k1/c,$$

where k is a constant.

Using methane as the standard to obtain the value of k, the observed and calculated values of L are as follows:

Gas.	L observed.		L calculated.
Methane	5·60	standard	5·60
Ethane	3·10		3·15
Propane.....	2·17		2·19
n-Butane	1·65		1·68
n-Pentane.....	1·37		1·36
*iso*Pentane	1·32		1·36

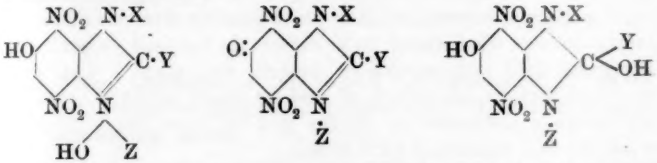
276. "Formation of six- and seven-membered rings from derivatives of 2 : 2′-ditolyl." By James Kenner and Emily Gertrude Turner.

Continuing their studies on the cyclic condensation of derivatives of 2 : 2′-ditolyl, which have been shown to lead to the formation of phenanthrene (this vol., p. 92), the authors have found that 2 : 2′-dialdehydodiphenyl is converted by the action of concentrated potassium hydroxide solution into *ω-hydroxy-2-methyldiphenyl-2′-carboxylic acid*, m. p. 146°, from which an *ε-lactone*, m. p. 132°, is obtained by heating it at 110°.

2:2′-*Ditolyl*-ωω′-*dicarboxylonitrile* undergoes condensation under the influence of sodium ethoxide, with formation of 1-*imino*-2-*cyano*-3:5-*dibenzo*-$\Delta^{3:5}$-cyclo*heptadiene*, m. p. 189°. This substance is hydrolysed by sulphuric acid, with formation of 1-*imino*-3:5-*dibenzo*-$\Delta^{3:5}$-cyclo*heptadiene*-2-*carboxylic acid*, m. p. 180°, which yields 3:5-*dibenzo*-$\Delta^{3:5}$-cyclo*heptadien*-1-*one*, m. p. 78—79°, by further hydrolysis with dilute acid.

277. "**Syntheses with phenol derivatives containing a mobile nitro-group. Part V. Quinoneimides, asymmetric quaternary ammonium compounds, and asymmetric carbinols (continued).**" By **Raphael Meldola and Harold Kuntzen.**

The authors gave further proof of the general applicability of their method of synthesising dinitroiminazolium compounds, iminazolones, and iminazolols. A series of new compounds was described, in which the radicles X and Y in the formulæ given below had been varied:



In the new series X represented phenyl, *p*-anisyl, *p*-chlorophenyl and benzyl; Y = ethyl and *iso*butyl, and Z = methyl. A further consideration of possible formulæ for the quinoneimidonium compounds led the authors to maintain the correctness of their original view as expressed by the formulæ adopted. It was pointed out that the quinquevalent nitrogen atom in these compounds was comparable with that contained in compounds of the oxyammonium type, $O{:}N(R)_3$, the highly acid quinonoid radicle representing the oxygen atom. Independent evidence of the existence of such quinoneimidonium compounds had been obtained in the course of a further study of the product of the extreme methylation of *iso*picramic acid (*Proc.*, 1910, **26**, 232), and the authors stated that this research was in progress.

278. "**Isomeric acetaldehydephenylhydrazones.**" By **Ernyst Graham Laws and Nevil Vincent Sidgwick.**

Lockemann and Liesche's work on this subject has been repeated and confirmed in more detail. The hydrazone was prepared by the interaction of acetaldehyde and phenylhydrazine in aqueous alcohol.

The product is a mixture of the two isomerides. The α-form, m p. 98·6°, is obtained by recrystallisation from alkaline aqueous alcohol, and the β, m. p. 56·6°, by recrystallisation from acidified aqueous alcohol. Aqueous and gaseous alkalis and acids cause the isomeric change without the hydrazone passing into solution, and without any apparent change in the crystals themselves.

The freezing-point curve has been obtained, and shows that the two isomerides form a continuous series of mixed crystals (solid solutions). The crystals of the two forms appear to be identical, and they have the same density. The influence of a solvent is to give an equilibrium mixture containing about 75 per cent. of the α-form. The hydrazone can be distilled in a vacuum, and the isomerides pass over at temperatures 100° apart.

The peculiarity of the isomerism must be connected with the small difference in the relative stability of the two forms. On the other hand, there is no doubt that the α-modification is more stable in the presence of alkali, and the β- in the presence of acid, and that a trace of alkali or acid can bring about a change proceeding through a mass of crystals without their passing into solution. It therefore follows that there is a difference between crystals in contact with acid and crystals in contact with alkali. This can only come about by adsorption of acid or alkali into the crystals, which causes a difference in energy greater than the difference between the two absolutely pure forms.

279. "Nitrites of the alkylammonium series. Part IV. Triethylammonium nitrite and its decomposition and sublimation by heat." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

Triethylammonium nitrite is obtained by the interaction of triethylamine hydrochloride and silver nitrite in aqueous solution and evaporation of the filtrate in a vacuum over sulphuric acid. The salt crystallises in pale yellow tablets and prisms. When heated it decomposes into triethylamine, alcohol, and ether, nitric oxide, nitrous oxide, and nitrogen being evolved; at the same time a portion of it sublimes unchanged.

280. "The formation of dichlorocarbamide and its behaviour towards amines." By Rasik Lal Datta.

In the preparation of dichlorocarbamide, Chattaway (*Proc. Roy. Soc.*, 1908, **81**, 381) ascribed the small yield which he obtained to the hydrolysis of the compound by the acid liberated in the reaction. It has now been found that during the formation of

dichlorocarbamide, carbamide hydrochloride is produced, which diminishes the yield, being itself incapable of chlorination. The action of bromine on carbamide has been studied, and the results seem to point to the formation of dibromocarbamide in solution. The behaviour of amines with dichlorocarbamide has also been investigated, the result being the formation of chloroamines, with or without the evolution of gas.

281. "Synthetical experiments in the group of the *iso*quinoline alkaloids. Part II. The constitution of the condensation products of cotarnine and the condensation of cotarnine with aliphatic and aromatic nitro-compounds." By Edward Hope and Robert Robinson.

An account was given of the condensation of cotarnine with nitromethane, and with a number of derivatives of nitrotoluene: *o*- and *p*-nitrotoluene condense in the presence of sodium ethoxide, whilst nitromethane, di- and tri-nitrotoluenes, and also trinitroxylene and trinitromesitylene condense in the absence of any agent.

282. "The synthesis of derivatives of thioxanthone. Part IV. Synthesis from aromatic sulphinic acids." By Harold Christopher and Samuel Smiles.

It was shown that derivatives of thioxanthone may be obtained by heating together a sulphinic acid with a *m*-hydroxy- or amino-benzoic acid. A few typical examples of this synthetical method were given. From benzenesulphinic acid and *m*-aminobenzoic acid 2-aminothioxanthone was obtained, whilst *o*- and *p*-toluenesulphinic acids with *m*-amino- or hydroxy-benzoic acid yielded the corresponding amino- or hydroxy-thioxanthones. Hydroxythioxanthone, prepared by another method, was also investigated.

283. "Komppa's synthesis of camphoric acid." By Gustave Louis Blanc and Jocelyn Field Thorpe.

The authors find that when methyl diketocamphorate is hydrolysed by very dilute alkali, that is, under conditions comparable with those used by Komppa in his synthesis of camphoric acid, the methyl group remains attached to carbon. Their criticism of this synthesis is therefore baseless.

284 "The electrochemistry of solutions in acetone. Part I." By Alexander Roshdestwensky and William Cudmore McCullagh Lewis.

The object of the experiments was to find if the Nernst expressions for the electromotive forces of concentration cells hold good in acetone solution. Conductivity measurements were carried out in the case of lithium nitrate and silver nitrate in order to determine the ionic concentration values required for the calculation of the cell $Ag \left| \begin{matrix} AgNO_3 : AgNO_3 \\ C_1 \quad\quad C_2 \end{matrix} \right| Ag$, which includes in its simple form a liquid|liquid potential difference, and also for the calculation of *E.M.F.*'s when attempts are made to remove the liquid|liquid potential difference. The results obtained on comparing calculated and found values support the view that the simple osmotic formulæ are applicable.

285. "Chlorination of α-naphthol by acetylchloroamino-2 : 4-dichlorobenzene." By Harold King.

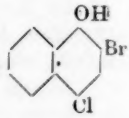
With the exception of Kast's (*Ber.*, 1911, **44**, 1337) recent preparation of 4-chloro-α-naphthol by the use of sulphuryl chloride, the four known monochloro-α-naphthols have only been obtained by indirect methods.

In investigating the direct chlorination of α-naphthol, the author has used the method described by Orton and King (*Trans.*, 1911, **99**, 1185). The naphthol is treated in glacial acetic acid solution with a molecular proportion of acetylchloroamino-2 : 4-dichlorobenzene and 1/100th of a gram-molecular proportion of hydrochloric acid, whereby the concentration of the chlorine set free is kept at a low value. The chlorination is rapid, and unaccompanied by oxidation. The diluted acetic acid solution is extracted with chloroform, and the latter removed by a current of warm air. The chlorinated product is separated from the accompanying dichloroacetanilide by extraction with a 2 per cent. sodium hydroxide solution, and a single crystallisation from light petroleum (b. p. 60—85°) gives a 40 to 50 per cent. yield of almost pure 4-chloro-α-naphthol. The exceedingly soluble residue *A*, recovered from the petroleum mother liquor, corresponds in melting point and properties with the so-called monochloronaphthol of Claus and Oehler (*Ber.*, 1882, **15**, 312), Cleve (*Ber.*, 1888, **21**, 891), and Kalle & Co. (D.R.-P. 167458). By fractional precipitation from alkaline solution by dilute mineral acid, a very partial separation into substances of different acidity takes place. [Cleve (*loc. cit.*) could obtain no pure product in this

way.] Nevertheless, the first 25 per cent. precipitated when recrystallised from dilute acetic acid yields hexagonal, scaly crystals of α-naphthol.

2:4-Dichloro-α-naphthol, crystallising in needles, can be obtained in quantity from *A* by repeated crystallisation from dilute acetic acid containing 10 to 20 per cent. of water. No indication of the presence of other monochloro-α-naphthols in the mixture was observed, and hence, if present, they must be very small in amount. It is seen, therefore, that the composition of the initial chlorinated product approximates to 50 per cent. of 4-chloro-α-naphthol, 30 per cent. of dichloro-α-naphthol, and 20 per cent. of α-naphthol, the two latter obviously being present in equimolecular proportions. The determination of the melting-point curve for mixtures of α-naphthol and dichloro-α-naphthol afforded additional evidence that the soluble residue *A* consisted of equimolecular proportions of α-naphthol and dichloro-α-naphthol, with a very small quantity of 4-chloro-α-naphthol.

4-Chloro-α-naphthyl benzoate, $C_{10}H_6Cl\cdot OBz$ (m. p. 99—100°; Autenrieth and Mühlinghaus, *Ber.*, 1907, **40**, 748, give 100—101°), was obtained by benzoylation of 4-chloro-α-naphthol. It is readily soluble in all the ordinary organic solvents, except light petroleum. (Found, Cl = 12·46. Calc., Cl = 12·55 per cent.)

4-Chloro-2-bromo-α-naphthol, 

By bromination of 4-chloro-α-naphthol in acetic acid solution, *4-chloro-2-bromo-α-naphthol* was obtained. It crystallises from benzene in lustrous, white needles, melting at 94—95°. It is very readily soluble in the common organic solvents. From acetic acid it separates in glassy prisms, containing acetic acid, which become opaque, and disintegrate on the water-bath:

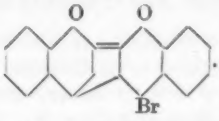
0·1990 gave 0·2559 AgCl + AgBr. Cl + Br = 44·81.

$C_{10}H_6OClBr$ requires Cl + Br = 44·82 per cent.

Its constitution was proved by oxidation with fuming nitric acid, whereby 2-bromo-α-naphthaquinone and Liebermann and Schlossberg's β-dinaphthyl-α-diquinone (*Ber.*, 1899, **32**, 548) were obtained.

4-Chloro-2-bromo-α-naphthol resembles 2:4-dichloro- and 2:4-dibromo-α-naphthol in its behaviour towards alkalis. On exposure of its solution in alkalis to sunlight, it is quantitatively converted into a deep blue, insoluble substance, which still contains bromine. The fact that the ortho-bromine atom is not displaced is not in

harmony with Bruncke's formula (*Diss.*, Marburg, 1903) for the corresponding compound obtained from dibromo-α-naphthol:



Preparation of 2:4-*Dichloro-α-naphthol.*—The employment of two molecular proportions of acetylchloroamino-2:4-dichlorobenzene to one of α-naphthol serves as a quantitative method of obtaining dichloro-α-naphthol free from tri- and penta-chloroketonaphthalenes which are formed when a current of chlorine is used for the chlorination.

ADDITIONS TO THE LIBRARY.

III. *Pamphlets.*

Beveridge, *Wilfred William Ogilvy.* A report on the determination of the amount of tin in tinplate used for canning preserved food. (From the *J. Roy. Army Med. Corps*, 1911.)

Bock, *Johannes.* Über die Ausscheidung der Alkalimetalle bei der Purindiurese. (From the *Skand. Arch. Physiol.*, 1911, **25.**)

Brauns, *Dirk Hendrik.* Theory of the rotation of the plane of polarisation. pp. 21. Detroit 1911.

Contino, A. Sulla quantità di manganese in alcuni terreni Italiani. (From the *Staz. sper. agrar. ital.*, 1911, **44.**)

Gross, *Oscar.* Untersuchungen über das Verhältniss von Stickstoff zu Schwefel im Stoffwechsel. (From the *Zeitsch. exp. Path. Ther.*, 1911, **9.**)

Heiduschka, *Alfred*, and **Biéchy,** *Theodor.* Bestimmung des Arsens im Harn nach Anwendung von Salvarsan. (From the *Apoth. Zeit.*, 1911.)

Kraft, *F.* Die Glykoside der Blätter der Digitalis purpurea. (From the *Schweiz. Wochensch. Chem. Pharm.*, 1911.)

Lange, *Hans.* Studien über die Zusammensetzung heliumführender Mineralien. (From the *Zeitsch. Naturwiss. Halle*, 1910, **82.**)

Masoni, *Giulio.* Saggio sull' azione del solfato di Manganese in rapporto alla vegetazione. (From the *Staz. sper. agrar. ital.*, 1911, **44.**)

Mingaye, *John C. H.*, and **White,** *Harold P.* Analyses of artesian and sub-artesian waters in New South Wales. pp. 8. Sydney 1911.

Paderi, *Cesare.* Richerche sulle proprietà biologiche dell' acido glicuronico. I. (From the *Arch. Farm. sperim. Sci.*, 1911, **11.**)

Piccinini, *Guido M.* Il metabolismo del manganese e la legge del minimo tra manganese e ferro. (From the *Arch. Farm. sperim. Sci.*, 1910, **10.**)

—— Il manganese come attivatore o cinasi non specifica e il Manganese colloidale. (From the *Biochem. Terap. sperim.*, 1910, **2.**)

Prandi, *Oreste,* and **Civetta,** *Angelo.* Il manganese nel vino. (From the *Staz. sper. agrar. ital.*, 1911, **44.**)

Shepherd, *Ernest S.*, and **Rankin,** *George A.* Preliminary report on the ternary system CaO–Al_2O_3–SiO_2. A study of the constitution of Portland cement clinker. With optical study by *Fred. E.* **Wright.** (From the *J. Ind. Eng. Chem.*, 1911, **3.**)

Sundwik, *Ernst Edw.* Xanthinstoffe aus Harnsäure. (From the *Skand. Arch. Physiol.*, 1911, **25.**)

Thunberg, *Torsten.* Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. X. (From the *Skand. Arch. Physiol.*, 1911, **25.**)

Tigerstedt, *Robert.* Zur Kenntnis der Aschebestandteile in der frei gewählten Kost des Menschen. (From the *Skand. Arch. Physiol.*, 1910, **24.**)

Venturoli, *Giuseppe,* and **Gallerani,** *Guido Tartarini.* Contributo allo studio chimico-tossicologico dell' Adrenalina. (From the *Giorn. Farm. Chim.*, 1911, **60.**)

Walter, *Johann.* Einige Notizen über die zwischen aromatischen Amino- und Nitrokörpern auftretenden Färbungen. (From the *Zeitsch. Farb.-Ind.*, 1911.)

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 4th, 1911.

All persons who received grants in December, 1910, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Friday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encourage-

ment of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

MARCELIN BERTHELOT MEMORIAL LECTURE.

An Extra Meeting will be held on Thursday, November 23rd, 1911, at 8.30 p.m., when the Berthelot Memorial Lecture will be delivered by Professor Harold B. Dixon, M.A., Ph.D., F.R.S.

At the next Ordinary Scientific Meeting on **Thursday**, November **16th**, 1911, at **8.30** p.m., the following papers will be communicated:

"The influence of neutral solvents on velocity of reaction. Part I. Transformation of anis*syn*aldoxime in various solvents." By T. S. Patterson and H. H. Montgomerie.

"Organic derivatives of antimony. Part II. The orienting influence of antimonic substituents in the benzene nucleus." By G. T. Morgan and Miss F. M. G. Micklethwait.

"Chemical examination of calabar beans." By A. H. Salway.

"Copper salts and their behaviour with alkalis." By S. U. Pickering.

"Contributions to the chemistry of the terpenes. Part XII. Synthesis of a menthadiene from thymol, and of a diethyl*cyclo*hexadiene from phenol." By G. G. Henderson and R. Boyd.

R. CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.

[*Issued* 29/11/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 392.

Thursday, November 16th, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Mr. R. W. Merriman was formally admitted a Fellow of the Society.

The PRESIDENT read the following letter:

HOME OFFICE,
WHITEHALL.
July 24th, 1911.

SIR,

I am commanded by the King to convey to you hereby His Majesty's thanks for the Loyal and Dutiful Address of the President, Council, and Fellows of the Chemical Society on the occasion of Their Majesties' Coronation.

I am, Sir,
Your obedient servant,
(*Signed*) WINSTON S. CHURCHILL.

To the Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.

The PRESIDENT made the following statements:

(*a*) An Address had been presented, on behalf of the Society, to the Royal Academy of Sciences of Turin, on the occasion of the centenary commemoration of Amedeo Avogadro:

THE CHEMICAL SOCIETY

TO

THE ROYAL ACADEMY OF SCIENCES OF TURIN.

GREETING,

We, the President and Officers, desire on behalf of the Chemical Society to associate ourselves with you in doing honour to the memory of your illustrious compatriot, Amedeo Avogadro.

Of all the pillars upon which the edifice of modern chemistry is supported there is assuredly none more fundamental, excepting the atomic theory, than the famous and illuminating hypothesis formulated one hundred years since by Avogadro. It would be difficult to exaggerate the indebtedness of Chemical Science to the great Italian Physicist, whose inspired fancy penetrated so deeply into the mysteries of the gaseous state of matter that he was able to reveal its ultimate and quantitative structure to the world.

We would take the opportunity of this Centenary Commemoration to congratulate Italy, not only on this magnificent conception of Avogadro, but also on its far-reaching fructification nearly fifty years later through the genius of Stanislao Cannizzaro.

Signed on behalf of the Chemical Society:

PERCY F. FRANKLAND, *President.*
ALEXANDER SCOTT, *Treasurer.*
G. T. MORGAN } *Honorary*
ARTHUR W. CROSSLEY } *Secretaries.*
HORACE T. BROWN, *Foreign Secretary.*

Dated this Twentieth Day of July, One Thousand Nine Hundred and Eleven.

(*b*) A Committee had been formed with the object of raising funds for the purpose of erecting a memorial to the memory of Jacobus Henricus van't Hoff, who died on March 1st, 1911. It is proposed to erect a statue of van't Hoff in Amsterdam, where he carried out most of his teaching work, and made most of his important discoveries. Further, to found an "International van't Hoff Institution," from the funds of which Institution scientific investigations will be supported.

Subscriptions may be sent to the Treasurer of the Society (Dr. A. Scott).

(*c*) A communication has been received from Professor A. Haller stating that it is proposed to raise a memorial to the late Professor Paul Schützenberger, and inviting subscriptions to the fund, which should be sent to M. Emile Blondel, 2, rue Ampère, Rouen.

Certificates were read for the first time in favour of Messrs.:

Thomas Sharp Dick, 15, South Street, Greenock, N.B.
Harold Forster Dodson, 6, Lune Street, Saltburn-by-the-Sea.
Ernest George Gaul, M.Sc., The College, Holmes Chapel, Cheshire.
Herbert Middleton, M.Sc., 7, Howard Street, Horton Lane, Bradford.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

Charles Christian Gardthausen, Assistant Curator, Geological Survey, Pretoria.
James Hogan Hill, c/o Opium Agent, Ghazipur, U.P., India.
Gaston Nilié-Martin, S. African Sugar Refineries, Ltd., South Coast Junction, Natal.
John Ffraid Richardson, Government Quinine Factory, Mungpu, P.O., Sonada, D.H. Railway, India.
Alexey Mikhailovich Vassiliev, The University, Kasan, Russia.

Of the following papers, those marked * were read:

*286. "Chemical examination of Calabar beans." By Arthur Henry Salway.

In connexion with the preparation of a quantity of the alkaloid physostigmine (eserine), the opportunity was taken for a more complete examination of the other constituents of Calabar beans. The physostigmine, $C_{15}H_{21}O_2N_3$, thus obtained melted at 86—87°, whereas the recorded melting point of this alkaloid is 105—106°, which was found to agree with a pure commercial specimen of physostigmine. This discrepancy was proved to be due to the fact that the alkaloid is dimorphous. In addition to the above alkaloid, the following compounds were isolated: A new alkaloid, *physovenine*, $C_{14}H_{18}O_3N_2$ (m. p. 123°); a new dihydric alcohol, *calabarol*, $C_{28}H_{36}O_4$ (m. p. 245°), which yields a *dibenzoyl* derivative, melting at 195—196°; trifolianol, $C_{21}H_{36}O_4$; and palmitic, stearic, behenic, oleic, and linolic acids. A considerable amount of sugar was also present, which yielded *d*-phenylglucosazone (m. p. 205°). The alkaloid eseramine (m. p. 245°) and the compounds designated as stigmasterol, $C_{30}H_{48}O$, and sitosterol, $C_{27}H_{46}O$, which had previously

been isolated from Calabar beans, were also obtained. It was, however, not found possible to confirm the statements respecting the presence in Calabar beans of the alkaloids designated as "eseridine" and "*iso*physostigmine" respectively.

Discussion.

Dr. Veley inquired if the author had studied any physiological properties of his purified samples of physostigmine (eserine) or its salts, such as the hydrochloride or hydrobromide. Having regard to the poisonous properties of the Calabar bean, from which the base is obtained, experiments on the effects on isolated muscle or nerve of the constituent base would be of especial importance in medico-legal cases.

Dr. Salway stated that the new alkaloid physovenine, $C_{14}H_{18}O_3N_2$, possessed powerful myotic properties, being similar in this respect to physostigmine, but that its physiological action had not been further determined.

***287. "Organic derivatives of antimony. Part II. The orienting influence of antimonic substituents in the benzene nucleus." By Gilbert T. Morgan and Frances M. G. Micklethwait.**

When treated with a mixture of concentrated nitric and sulphuric acids, phenylstibinic acid, diphenylstibinic acid, and triphenylstilbine hydroxynitrate yield nitro-derivatives containing one nitro-group in each benzene nucleus present in the molecule. The orientation of these nitro-groups with respect to the antimonic radicles was determined by suspending the nitro-compounds in dry chloroform, and heating with a mixture of phosphorus pentabromide and bromine at 120—140°. These reagents bring about the replacement of antimony by bromine, the fission products being 1-bromo-3-nitrobenzene and antimony bromide. The presence of quinquevalent antimony in the benzene ring determines the introduction of a nitro-group in accordance with the meta-law of substitution.

m-*Nitrophenylstibinic acid*, $NO_2{\cdot}C_6H_4{\cdot}SbO(OH)_2$, *di*-m-*nitrodiphenylstibinic acid*, $(NO_2{\cdot}C_6H_4)_2SbO{\cdot}OH$, and *tri*-m-*nitrotriphenylstibinic acid*, $(NO_2{\cdot}C_6H_4)_3Sb(OH)_2$, are sparingly soluble, yellowish-white, amorphous compounds, yielding soluble alkali salts. The reduction of the last of these acids leads to the formation of *tri*-m-*aminotriphenylstibine* $(NH_2{\cdot}C_6H_4)_3Sb$.

The prolonged interaction of triphenylstibine and antimony chloride in xylene solution at 240° results in the formation of diphenylstibine chloride and phenylstibine dichloride:

$$2Ph_3Sb + 4SbCl_3 = 3Ph_2SbCl + 3SbCl_3 \rightleftharpoons 6PhSbCl_2$$

(compare Hasenbäumer, *Ber.*, 1898, **31**, 2911; Michaelis and Gunther, *Ber.*, 1911, **44**, 2316).

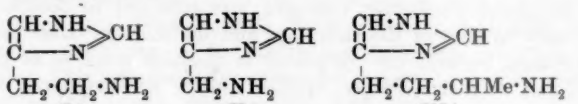
Discussion.

Dr. Pyman pointed out that Ehrlich and Bertheim (*Ber.*, 1907, **40**, 3297) proved the orientation of *p*-aminophenylarsinic acid by converting it into *p*-iodoaniline by boiling with sulphuric acid and potassium iodide, and inquired whether the authors had tried this method on their aminophenylstibinic acids.

Dr. Morgan replied that the method had been tried, but had proved to be inapplicable in the case of the antimony compounds dealt with.

*288. "Aminoalkylglyoxalines." By Frank Lee Pyman.

For comparison of their physiological activity with that of 4(or 5)-β-aminoethylglyoxaline (I), several aminoalkylglyoxalines have been prepared:



(I.) (II.) (III.)

4(or 5)-Aminomethylglyoxaline (II) was obtained by the oxidation of 2-thiol-4(or 5)-aminomethylglyoxaline with ferric chloride.

γ-*Amino*-4(or 5)-*butylglyoxaline* (III) was formed on the reduction of the oxime of γ-*keto*-4(or 5)-*butylglyoxaline*,

$$C_3H_3N_2\cdot CH_2\cdot CH_2\cdot COMe,$$

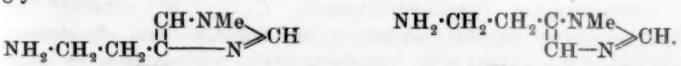
a base resulting from the hydrolysis of ethyl 4(or 5)-glyoxaline-methylacetoacetate.

βγ-*Bis*[4(or 5)-*glyoxaline*]*propylamine*,

$$C_3H_3N_2\cdot CH_2\cdot CH(CH_2\cdot NH_2)\cdot C_3H_3N_2,$$

resulted from the reduction of αβ-bis[4(or 5)-glyoxaline]propionitrile.

1-*Methyl*-4-β-*aminoethylglyoxaline* (IV) and 1-*methyl*-5-β-*aminoethylglyoxaline* (V) were prepared by reducing 1-*methyl*-4-*cyanomethylglyoxaline* and 1-*methyl*-5-*cyanomethylglyoxaline* respectively, the two isomerides produced by methylating 4(or 5)-cyanomethylglyoxaline:



(IV.) (V.)

289. "The influence of neutral solvents on velocity of reaction. Part I. Transformation of anis*syn*aldoxime in various solvents." By Thomas Stewart Patterson and Harvey Hugh Montgomerie.

The influence of various neutral solvents on the rate of transformation of anis*syn*aldoxime in the presence of ethyl tartrate was described, the results being discussed in connexion with other work of a similar character.

290. "Copper salts and their behaviour with alkalis." By Spencer Umfreville Pickering.

Copper salts of organic acids containing no alcoholic hydroxyl react with alkalis to form insoluble basic salts, whilst those of the oxy-acids form soluble cupri-compounds, either of the *cis*- or *trans*-description; in some cases a certain amount of basic salt is also formed. *trans*-Cupri-salts of monobasic acids are, in nearly every case, very unstable.

Further evidence that copper in cupri-salts is present as CuO, and not as copper displacing hydrogen, was obtained in several cases, especially in that of the salicylate and malate, the latter being of importance, because the compound in question must be of the *cis*-type, and former evidence applied chiefly to compounds of the *trans*-type.

In the case of copper glycerate, a cupri-compound has been obtained, differing in composition from the normal salt only by the elements of water, but certainly not being a mere hydrate. The two compounds have very different solubilities, colours, and decomposition temperatures; and in solution the cupri-compound may easily be converted into the normal salt.

Thirteen basic salts precipitated by alkali from salts of acids containing no alcoholic hydroxyl conform to formulæ representing 1, 3, or 7CuO united with a molecule of the normal salt. Besides these, about twenty new compounds have been obtained.

291. "Contributions to the chemistry of the terpenes. Part XII. Synthesis of a menthadiene from thymol, and of a diethyl*cyclo*-hexadiene from phenol." By George Gerald Henderson and Robert Boyd.

Thymomenthol (hexahydrothymol), $C_{10}H_{19}\cdot OH$, obtained by hydrogenating thymol according to Sabatier and Senderens' method, when heated with anhydrous oxalic acid yields as an intermediate product *thymomenthyl oxalate*, a crystalline solid, melting

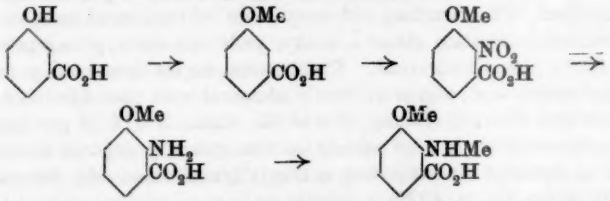
at 90°, and finally Δ^3-menthene, $C_{10}H_{18}$. This hydrocarbon unites with bromine to form an oily dibromide, $C_{10}H_{18}Br_2$, which when heated with alcoholic potassium hydroxide yields a menthadiene, $C_{10}H_{16}$, probably the $\Delta^{2:4}$-isomeride, a liquid which boils at 173—174°.

3:5-Diethylphenol, prepared synthetically from phenol, is converted into 1:3-*diethyl*cyclo*hexan*-5-*ol*, $C_{10}H_{19}\cdot OH$, a liquid boiling at 203—205° when heated with hydrogen in presence of nickel. When dehydrated with anhydrous oxalic acid, the latter compound yields 1:3-*diethyl*-Δ^4-cyclo*hexene*, $C_{10}H_{18}$, a liquid which boils at 163—166°, and unites with bromine, forming an oily *dibromide*, $C_{10}H_{18}Br_2$. On treatment with alcoholic potassium hydroxide, the dibromide yields a 1:3-*diethyl*cyclo*hexadiene*, $C_{10}H_{16}$, probably the $\Delta^{3:5}$-isomeride, a liquid which boils at 166—168°, and resembles in several respects the monocyclic terpenes.

292. "The synthesis of damasceninic acid (2-methylamino-3-methoxybenzoic acid)." (Preliminary note.) By Arthur James Ewins.

The alkaloid damascenine is readily converted into the isomeric damasceninic acid (Pommerehne, *Arch. Pharm.*, 1900, **238**, 531). The latter was shown to be 2-methylamino-3-methoxybenzoic acid by Keller, who unsuccessfully attempted its synthesis from methylanthranilic acid (*Arch. Pharm.*, 1908, **246**, 1).

The acid has now been synthesised from *m*-hydroxybenzoic acid by a series of reactions represented as follows:



Since damasceninic acid can be reconverted into the original alkaloid (Keller, *loc. cit.*), the synthesis of the latter is virtually accomplished.

293. "The oxidation of camphene with hydrogen peroxide." (A correction.) By George Gerald Henderson and Maggie Millen Jeffs Sutherland.

Geh. Rat Professor Dr. Bredt has pointed out to the authors what they had unfortunately overlooked, that the name "camphylic acid" which they proposed for the acid $C_{10}H_{16}O_2$ (m. p. 95°),

obtained by oxidising camphene with hydrogen peroxide (Henderson and Sutherland, *Trans.*, 1911, **99**, 1539), has already been applied by Perkin to the acid which he prepared by fusing sulphocamphylic acid with potassium hydroxide. Professor Aschan has also informed the authors that he has found an acid which apparently is identical with theirs among the products of the oxidation of camphene with potassium permanganate in acetic acid at a low temperature, and he suggests for it the name "camphenanic acid." As this name is very appropriate, the authors are glad to adopt the suggestion, and to designate the acid melting at 95° *camphenanic* instead of *camphylic* acid.

294. "Note on the preparation of labile benzaldehydephenylhydrazone." By Ferdinand Bernard Thole.

Thiele and Pickard have shown (*Ber.*, 1898, **31**, 1250) that ordinary benzaldehydephenylhydrazone is converted into a labile form when its suspension in acetic anhydride is treated with concentrated sulphuric acid and the resulting solution is poured into water. The author has experienced some difficulty in obtaining this product in a crystalline condition, but a good yield of the labile isomeride has been obtained by the method recently described (Dunstan and Thole, this vol., p. 233) for the preparation of *syn*-oximes.

Powdered benzaldehydephenylhydrazone is suspended in concentrated hydrochloric acid, and hydrogen chloride passed in to saturation. The resulting red suspension when poured into excess of sodium carbonate gives a bulky, yellowish-white precipitate of the labile phenylhydrazone. The product crystallises readily from glacial acetic acid, and is evidently identical with that described by Thiele and Pickard (Found, N = 14·30. Calc., N = 14·29 per cent.). It melts at 136°, is very soluble in the ordinary organic solvents, and on repeated crystallisation is slowly transformed into the stable modification (m. p. 152°).

The substance is evidently not identical with the azo-compound, $C_6H_5 \cdot CH_2 \cdot N{:}N \cdot C_6H_5$, which has been recently described as a yellow oil (*Annalen*, 1910, **376**, 265).

When the stable modification is moistened with ether and exposed to a current of dry hydrogen chloride, it assumes an orange-red colour, and an increase in weight is obtained approximating to that demanded by the addition of two molecular proportions of hydrogen chloride. Attempts are being made to prepare other labile isomerides by the method described above.

295. "The separation of mixtures of organic acids by partial esterification." By John Joseph Sudborough and Ebenezer Rees Thomas.

The authors are able to show that mixtures of the following types: an $\alpha\beta$-unsaturated acid and its saturated analogue; an $\alpha\beta$-unsaturated acid and the $\beta\gamma$-isomeride; an $\alpha\beta$-unsaturated acid and the $\gamma\delta$-isomeride, can be readily separated by partial esterification, using the catalytic method. Under suitable conditions the separation is practically complete after one treatment with alcoholic hydrogen chloride. The method possesses many advantages over Fittig's method of separating mixtures of $\alpha\beta$- and $\beta\gamma$-unsaturated acids, more particularly as both acids can be recovered.

296. "Preparation of the ketones of the higher fatty acids." By Thomas Hill Easterfield and Clara Millicent Taylor.

The authors find that the ketones of the saturated higher fatty acids are very conveniently prepared by heating the acids with about one-tenth their weight of cast-iron turnings to a temperature of about 360°. The method gives good results with the acids from lauric to melissic. Stearic acid gives an 80 per cent. yield of stearone.

The unsaturated acids oleic, elaidic, and brassidic also yield ketones when heated with metallic iron, but the yield is not so good as in the case of the saturated acids. Oleone was shown to be present in commercial "distillation" oleic acid. The method does not give satisfactory results with acetic, butyric, phenylacetic, benzoic, suberic, or sebacic acids.

The following new compounds were described: *Diheptadecylcarbinol*, m. p. 89·5°, and its *acetate*, m. p. 56—61°. *Cerotoneoxime*, m. p. 78°. *Dipentacosylcarbinol*, m. p. 95°, and its *acetate*, m. p. 58—60°. *Montanone*, $C_{55}H_{110}O$, m. p. 97°, and its *oxime*, m. p. 82·5°. The corresponding secondary *alcohol*, $C_{55}H_{112}O$, m. p. 101°, and its *acetate*, m. p. 66°. *Melissone*, m. p. 99·5°, and its *oxime*, m. p. 84°. *Oleone*, $C_{35}H_{66}O$, m. p. 59°, and its *oxime*, m. p. 31°. *Elaidone*, m. p. 70°, and its *oxime*, m. p. 32°. *Brassidone*, m. p. 80°, and its *oxime*, m. p. 51°. The ketone of erucic acid was not obtained in a pure state.

297. "Complex thio-oxalates." By Charles Stanley Robinson and Humphrey Owen Jones.

In a former paper (Jones and Tasker, *Trans.*, 1909, **95**, 1904) it was shown that solutions of potassium dithio-oxalate gave an

intense magenta colour with a solution of a nickel salt and an intense brown with a cobalt salt; these colours were still visible in solutions containing 1 part of the metal in 40,000,000 parts of water. The behaviour of these solutions indicated the presence of a complex salt, and the authors have now prepared several of these complex salts and others containing palladium or rhodium.

The salts derived from nickel, palladium, and iron have the general formula $M''(COS)_4M'_2$. Potassium, sodium, ammonium, barium, lead, aniline, and phenyltrimethylammonium salts of nickelo-dithio-oxalic acid have been prepared. The molecular weights in solution and the electrical conductivities show that these salts are derived from a dibasic acid.

The salts containing cobalt or rhodium correspond with the formula $M'''(COS)_6M'_3$; determinations of molecular weight and electrical conductivities show that these are derived from a tribasic acid.

Aqueous solutions of nickelo-dithio-oxalic acid have been prepared, and have nearly the same conductivity as equivalent solutions of sulphuric acid, so that this acid is about as strong as sulphuric acid. These solutions decompose gradually on keeping.

298. "The absorption spectra of various iodine derivatives of benzene and toluene as vapours, in solution and in thin films." By John Edward Purvis.

The results proved that, in the ultra-violet regions, neither the vapours nor the alcoholic solutions, nor the thin films of iodobenzene, *o*- and *m*-iodotoluene, and *o*- and *m*-di-iodobenzene exhibited any bands of selective absorption, which had been found previously in the corresponding chlorine and bromine compounds under similar physical conditions, although the number of bands in the latter compounds is decreased as the weight and type of the substituted atom or group of atoms is increased. The phenomena were discussed from a consideration of the heavier iodine atom still further damping and dislocating the vibrations, so that the rhythmical oscillations or vibrations are destroyed, and no selective absorption is possible.

299. "The transformation of ammonium cyanate into carbamide." By Frederick Daniel Chattaway.

The course of the reaction which takes place when ammonium cyanate is transformed into carbamide has never been satisfactorily explained.

Up to a few years ago it was universally regarded as a peculiar case of isomeric change, and no consideration was given to the process by which the conversion is effected.

A review of the evidence leads to the conclusion that the explanation put forward by Walker and his co-workers is not correct, and that in the transformation, ammonium and cyanic ions play directly no part.

The change of non-electrolytically dissociated ammonium cyanate into carbamide appears to be a simple process only until the atomic readjustments consequent upon it are considered. It is then seen that if it is to be regarded as an intramolecular rearrangement, it is altogether unusual and exceptional.

The production of carbamide from ammonium cyanate and a large number of other reactions of allied compounds can be brought into harmony if they are regarded as instances of the well-known tendency of the carbonyl group to combine with groups such as R_2NH or R·OH, followed by subsequent atomic rearrangements involving only the transference of a hydrogen atom from an oxygen atom to a nitrogen atom, doubly linked to the carbon atom with which it is associated, thus:

$$\cdot N{:}C{:}O + H\cdot N{:} \rightleftharpoons \cdot N{:}C\begin{matrix}<^{OH}\\ _{N:}\end{matrix} \rightleftharpoons \cdot NH\cdot CO\cdot N{:}$$

The conversion of ammonium cyanate into carbamide should therefore be formulated as follows:

$$NH_4\cdot N{:}C{:}O \rightleftharpoons HN{:}C{:}O + NH_3 \rightleftharpoons HN{:}C\begin{matrix}<^{OH}\\ _{NH_2}\end{matrix} \rightleftharpoons H_2N\cdot CO\cdot NH_2,$$

What has hitherto been regarded as the oldest and best known example of isomeric change is therefore not a case of isomeric change at all, but a reaction between cyanic acid and ammonia exactly analogous to the reactions between *iso*cyanic esters and ammonia or amines, whereby substituted carbamides are formed.

300. "The condensation of ethyl citraconate with ethyl sodiomalonate. Formation of *cyclo*pentanone-4-carboxylic acid." (Preliminary note.) By Edward Hope.

This condensation has been previously examined by several investigators with widely differing results (Michael, *J. pr. Chem.*, 1887, [ii], **35**, 354; Auwers, Köbner, and v. Meyenburg, *Ber.*, 1891, **24**, 2893; Michael and Schulthess, *J. pr. Chem.*, 1892, [ii], **45**, 57; Ruhemann and Cunnington, *Trans.*, 1898, **73**, 1010; Michael, *Ber.*, 1900, **33**, 3757). As was first pointed out by Michael (*Ber.*, 1900, **33**, 3757), the solvent employed has an extraordinary influence on the course of the interaction. In ethereal solution, condensation

occurs, according to Michael, in the normal manner, with the production of ethyl β-methylpropane-αβγγ-tetracarboxylate (I), but in alcoholic solution the *cyclo*butane derivative (II) is supposed to be produced:

$CO_2Et\cdot CH_2\cdot CMe(CO_2Et)\cdot CH(CO_2Et)_2$ (I.) $CO_2Et\cdot CH<\begin{matrix}CMe(CO_2Et)\\CH(CO_2Et)\end{matrix}>CO$ (II.)

The importance of such a simple method for synthesising *cyclo*butane derivatives led the present author to examine the reaction more closely with the object, if possible, of extending its application. It was found, however, that the above assumptions regarding the course of the reaction were erroneous. In ether or benzene solution, ethyl citraconate and the sodium derivative of ethyl malonate yield ethyl butane-ααβγ-tetracarboxylate (III), because

$CO_2Et\cdot CHMe\cdot CH(CO_2Et)\cdot CH(CO_2Et)_2$ (III.)

$CO_2Et\cdot CH_2\cdot CH(CO_2Et)\cdot CH_2\cdot CH(CO_2Et)_2$ (IV.)

on hydrolysis this ester (III) gives a mixture of the well-known stereoisomeric butane-αβγ-tricarboxylic acids (m. p. 186° and 148—152° respectively).

In alcoholic solution the nature of the product depends on the temperature at which the reaction is conducted. At the ordinary temperature the main product is ethyl butane-ααββ-tetracarboxylate (IV), probably produced by the isomerisation of ethyl citraconate to ethyl itaconate, followed by the condensation of the latter with ethyl sodiomalonate in the normal manner. At the temperature of the steam-bath, however, the ethyl butane-ααββ-tetracarboxylate first produced undergoes internal condensation, with the formation of a *cyclo*pentane derivative. From the product of the reaction a keto-acid was obtained (m. p. 60—62°), which gave a semicarbazone (m. p. 196—198°) and an oxime (m. p. 177—179°).* This acid was compared directly, and found to be identical with the *cyclo*pentanone-4-carboxylic acid (V) described by Kay and Perkin (*Trans.*, 1906, **89**, 1646):

$CO_2H\cdot CH<\begin{matrix}CH_2\cdot CO\\CH_2\cdot CH_2\end{matrix}$ (V.)

It seems clear that the substance (I) is not formed in the above condensation, because the author has been unable to isolate even traces of β-methyltricarballylic acid from the products of hydro-

* The m.p. of this oxime is erroneously given by Kay and Perkin as 141°, instead of 177—179°.

lysis, and, indeed, this acid, which the author hopes to prepare, is at present unknown.

The author is also engaged in the further investigation of the mechanism of the formation of cyclic substances in reactions similar to that represented above.

301. "The relative activities of certain organic iodo-compounds." (Preliminary note.) By David Segaller.

The reactivities of some alkyl iodides with sodium phenoxide in alcoholic solution have been measured. The author finds in this reaction a normal decrease of the velocity constant with increase in molecular weight. The following iodides have been investigated: methyl, ethyl, propyl, *iso*propyl, butyl, *iso*butyl, *tert.*-butyl, *iso*amyl, *tert.*-amyl, hexyl. An abnormal result is obtained in the case of *iso*propyl iodide. Measurements are being made at various temperatures, and the investigation is being extended to other iodides and iodo-derivatives.

302. "Some α′-derivatives of camphor." By James Ernest Marsh.

When bromine acts on camphor mercuribromide, $C_{10}H_{15}O,HgBr$, the main product besides mercury bromide is α′-bromocamphor. Hence in the monomercuri-derivatives of camphor the mercury occupies the α′-position. The author has shown (*Trans.*, 1910, **97**, 240) that in the dimercuri-compounds the αα′-position is occupied by the mercury. When therefore the mono- are obtained from the di-derivatives the mercury in the α-position is replaced by hydrogen, whilst that in the α′-position remains. The production of α′-bromocamphor in another way, and its properties have been already described by the author (*Trans.*, 1890, **57**, 528). Whereas the crystals of ordinary α-bromocamphor show double refraction, Mr. T. V. Barker has found that α′-bromocamphor gives singly refracting crystals.

303. "The velocity of addition of alkyl bromides to cyclic tertiary bases." By Frank Stevenson Long.

The rates at which various alkyl bromides, especially *iso*amyl, *iso*butyl, and *iso*propyl bromides, combine with pyridine, α- and β-picolines, and quinoline in amyl-alcoholic solution have been determined at 92·6°.

It was found that *iso*amyl bromide reacts, on the average, seven times, and *iso*propyl bromide three times, more rapidly than *iso*butyl

bromide. These results, on comparison with those of other workers, seem to indicate that *iso*propyl compounds, owing to their secondary nature, are not strictly comparable with *iso*butyl and *iso*amyl compounds, since with some reagents they are more, and with others less, reactive than the other alkyl bromides. Except for this there is manifested considerable regularity explicable on steric hypotheses.

304. "The essential oil of Origanum hirtum, Link." (Preliminary note.) By Samuel Shrowder Pickles.

The *Origanum* oils are mostly obtained from countries bordering on the Mediterranean, and the two chief varieties known in commerce are (1) Trieste origanum oil, and (2) Smyrna origanum oil. It has long been assumed that the former is the product of *O. hirtum*, Link, and an oil was examined by Jahns in 1879 (*Arch. Pharm.*, 1879, **215**, 1) which was obtained from a plant identified by Grisebach as *O. hirtum*, Lk. This oil consisted mostly of carvacrol, no thymol being found in it.

Early in the present year a consignment of herb described as "Origanum Plant" was received at the Imperial Institute from the Trieste Commercial Museum. Specimens of this material were identified at the Royal Gardens, Kew, as *O. hirtum*, Link. On chemical examination, however, the phenolic constituents of the oil obtained from this plant by distillation with steam were found to consist almost entirely of thymol, carvacrol being apparently absent.

The dry plant yielded 3·3 per cent. of a pale yellow oil, which possessed a pronounced odour of thymol and a burning taste. It gave the following results on examination: D^{15} 0·9440, α_D (in 100 mm. tube) +0°24′. The oil was soluble to a clear solution in 2·8 parts of 70 per cent. alcohol. An estimation of the phenols present by absorption in dilute sodium hydroxide solution gave 64·4 per cent. by volume, equivalent to 66—67 per cent. by weight.

A determination of the thymol present by conversion of the latter into its iodine derivation gave 68·4 per cent. of thymol (by weight). On seeding the original oil with a crystal of pure thymol, it rapidly deposited large quantities of this substance in beautiful crystals and in an approximately pure condition. The phenolic portion of the oil separated by means of sodium hydroxide solidified completely. Traces of another phenolic substance which gave a deep red coloration with ferric chloride were also observed.

This oil appears to be very similar to one recently examined by Schimmel & Co. (*Report*, October, 1911, p. 63).

305. "The essential oil of Dalmatian white thyme." (Preliminary note.) By Samuel Shrowder Pickles.

A supply of this herb has recently been received at the Imperial Institute from the Commercial Museum of Trieste. Specimens of the plant were submitted to the Royal Gardens, Kew, for botanical examination, and it was there identified as *Satureia*, sp., possibly one of the many forms of *S. montana*, Linn., which is often difficult to distinguish from *S. cuneifolia*, Tenore.

The dry herb, when distilled in a current of steam, yielded 1·64 per cent. of an oil possessing the characteristic odour of carvacrol. It had a sharp, burning taste, and a golden-yellow colour. The oil had D_{15}^{15} 0·9548, α_D −1°3′, and contained 68·75 per cent. of phenolic constituents, mostly carvacrol (nitroso-compound, m. p. 153—154°). The oil was soluble to a clear solution in 2·7 parts of 70 per cent. alcohol. The non-phenolic constituents of the oil are under examination.

This oil appears to be very similar to one recently examined by Schimmel & Co. (*Report*, October, 1911, p. 109).

306. "The molecular configuration of 1-methyl*cyclo*hexylidene-4-acetic acid and of the oxime of *cyclo*hexanone-4-carboxylic acid." By Arthur Ernest Everest.

In their paper on "Optically active derivatives of 1-methyl*cyclo*hexylidene-4-acetic acid" (*Trans.*, 1911, **99**, 1510) Perkin and Pope summararily dismiss the points raised by the author (*Chem. News*, 1909, **100**, 295) regarding the correctness of their view (Perkin, Pope, and Wallach, *Trans.*, 1909, **95**, 1789) that the compound under discussion contains no asymmetric carbon atom.

In view of the fact that the matter is of some considerable importance—Perkin and Pope in their paper (*ibid.*, p. 1511) say: "The discovery of the new type of optically active substances referred to involves a considerable extension of the whole subject of stereochemistry"—the author feels that a few further words on the subject will not be out of place.

From the outset the author wishes to point out that, as has already been mentioned in the Chemical Society's Annual Reports for 1909, his views are quite readily applicable to the case of the oxime of *cyclo*hexanone-4-carboxylic acid (III), described by Mills and Bain (*Trans.*, 1910, **97**, 1866), and regarding which they say (*loc. cit.*): "These substances may possess a certain interest in that they provide another example of compounds of which, like *d*- and *l*-inositol, and *d*- and *l*-1-methyl*cyclo*hexylidene-4-acetic acids

(Perkin, Pope, and Wallach, *loc. cit.*), the molecular asymmetry is more fittingly defined with reference to the configuration of the molecule as a whole than expressed in terms of the presence of some 'asymmetric atom.'"

The criticism contained in the author's previous paper (*loc. cit.*) was summed up in two alternative questions; Perkin and Pope have not satisfactorily answered either, but as justification for their claims they make three remarks, which, however, have no such effect.

Their first remark (*loc. cit.*) reads: "An asymmetric atom is never the cause of optical activity; optical activity is apparently invariable, and asymmetry of a carbon atom is, in special cases, the result of enantiomorphism of molecular configuration. Optical activity and the presence in the molecule of an asymmetric atom cannot be considered as mutually related in the sense of cause and effect." This statement compared with one made in their former paper on this subject, and which reads thus: "The optical activity is, in fact, not, as is still sometimes stated, due to the presence of an asymmetric carbon atom, but originates in the enantiomorphous molecular configuration." gives the whole of their position.

If, now, the contention of Perkin and Pope be proved correct, namely, that they, and Mills and Bain, have indeed produced compounds showing optical activity, *yet containing no asymmetric atom within their respective molecules*, then the author agrees that the above statements must be accepted; but, the author has shown—and in the present paper further supports his contentions—that both of the substances under discussion do contain an asymmetric carbon atom within their respective molecules. This being so, the author is of the opinion that the evidence bearing on this subject in literature is more likely to support his statement that it is a "generally accepted theory that the optical activity of a substance is due to the presence in it of an asymmetric atom," than to support the above statements of Perkin and Pope. On the other hand, the author would point out that such evidence as has thus far been gathered cannot be said to prove either of these statements.

In connexion with this, however, it is of interest to read a few lines which, if not written by Perkin, must at least have been assented to by him; thus on p. 544 of "Organic Chemistry," by Perkin and Kipping, we read: "That the property of rotating the plane of polarised light is *due* to the presence in the molecule of an asymmetric carbon atom is now practically proved by the fact that all optically active compounds of known constitution contain a carbon atom united in this way. ∴ ."

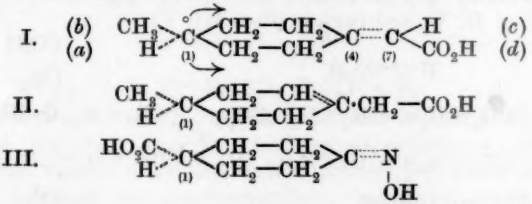
Now Perkin's change of view was quite natural when describing

what was then thought to be the first case of an optically active substance in the molecule of which there was no asymmetric atom, but, now that the substance has been shown to contain an asymmetric carbon atom within its molecule, does not the work only strengthen the proof spoken of in the passage from Perkin and Kipping referred to above?

In their second statement [*loc. cit.*, (*b*) p. 1511] the first portion makes it quite clear that Perkin and Pope admit the author's contention that the configuration of the remainder of the molecule is different when taken either way, relative to the carbon atom (1), for they deny having made the assumption that it was not so. In the second portion they give what is, presumably, their reason for considering—despite their statement in the first portion of this remark—that carbon atom (1) is not asymmetric. The author shows elsewhere in this paper that such an argument cannot stand.

Their statement (*c*), by reason of partial quotation, is not a true representation of the author's views. His view is, that carbon atom (1) of 1-methyl*cyclo*hexylidene-4-acetic acid has each of its four valencies differently occupied, and is hence asymmetric. This view is quite clear in his former paper, and had Perkin and Pope even considered the whole of their original quotation from that paper, instead of only a small portion, they could not have failed to see this point.

Now referring to the formula of 1-methyl*cyclo*hexylidene-4-acetic acid (I) [as previously, continuous lines represent bonds in the plane of the paper; broken lines bonds in a plane perpendicular to the first, and passing through carbon atoms (1), (4), and (7)]: in his



previous paper the author clearly pointed out that, in his opinion, carbon atom (1), whilst having two of its valencies attached to the hydrogen atom (*a*) and the methyl group (*b*) respectively, has the remaining two valencies (those forming part of the ring) attached to different systems, and hence, being attached to four quite dissimilar groups, is asymmetric.

This, it will be seen, very much resembles the manner in which Perkin and Pope (with Wallach) pointed out that carbon atom (1) in inositol was an asymmetric carbon atom (*loc. cit.*).

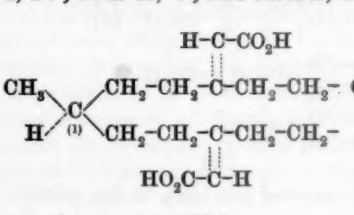
Now that Perkin and Pope [remark (*b*)] admit that the configuration of the 1-methyl*cyclo*hexylidene-4-acetic acid molecule, taken respectively in the direction of ↷ and in the direction of ⟶ relative to carbon atom (1), is not identical, it remains only to be shown that the difference is such that the carbon atom (1) is in the ordinary sense asymmetric.

Now to do so it is but necessary to compare the case of Marckwald and Meth's 1-methyl-Δ^3-*cyclo*hexene-4-acetic acid (II), regarding which Perkin and Pope (*loc. cit.*) say: "As the carbon atom numbered (1) in the latter constitutional formula is obviously attached to four constitutionally dissimilar groups, it is asymmetric in the ordinary sense;"

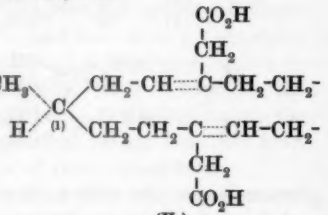
Now, in making comparisons, the rings only need be considered, for, taking carbon atom (1) in formulæ I and II, it is seen that in each case the two valencies which are outside the ring have attached to them a methyl group and a hydrogen atom. In formula III the methyl group is replaced by carboxyl.

Hence, if the difference shown between the two systems attached to carbon atom (1) and formed by the ring is in the case of 1-methyl*cyclo*hexylidene-4-acetic acid similar to that shown in the case of 1-methyl-Δ^3-*cyclo*hexene-4-acetic acid, then Perkin and Pope must surely admit that, on their own reasoning, the molecule of 1-methyl*cyclo*hexylidene-4-acetic acid contains an asymmetric carbon atom, the carbon atom (1).

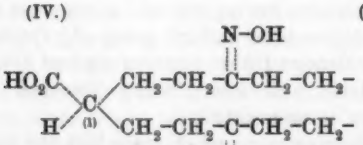
Now, treating the groupings as previously—and for that matter very much as done by Perkin, Pope, and Wallach for inositol—we get, on swinging open the ring of each molecule right and left, from I, IV; from II, V; and further, from III, VI:



(IV.)



(V.)

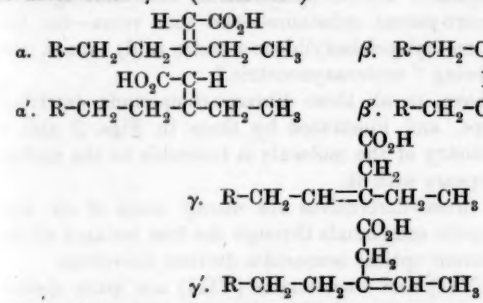


(VI.)

Now it is quite clear that in none of these cases, as they stand, are the two chain systems formed from the ring enantiomorphously related. In no way while remaining attached to the carbon atom (1) can they appear in the relation of object and mirror image; whilst, if they be detached from the carbon atom, they are *identical*. This is true of each of the three cases shown in IV, V, and VI respectively.

Hence it is seen that in reality, in each case, we are dealing with *one system*, but that that system is so constructed that the configuration relative to one end of the chain is different from that relative to the other end. The author therefore points out that, in his opinion, the differences thus shown in the systems attached to carbon atoms (1) in formulæ IV and VI must be considered to make those carbon atoms [(1) and (1)] asymmetric, if it is allowed that the differences shown by the two similar systems in formula V make carbon atom (1) of that formula asymmetric.

In support of this it may be pointed out that the compounds represented by α and α' and by β and β' would be expected to differ, α from α' and β from β', just as surely as γ would be expected to differ from γ'. (R not = H.)



Thus it is seen that the original conclusion of Perkin, Pope, and Wallach (*loc. cit.*) that in 1-methyl*cyclo*hexylidene-4-acetic acid they have realised "the first case of an optically active substance which possesses an enantiomorphous molecular configuration, although its constitutional formula contains no asymmetric atom," cannot be upheld, the methods used by them in removing Marckwald and Meth's acid and inositol from the field having been sufficient, when carefully applied, to trace the presence of an asymmetric carbon atom, both in the compound that they describe and also in that described by Mills and Bain. These compounds, therefore, are not centroasymmetric. Finally, it is necessary in this connexion to consider a statement made by Perkin and Pope in their recent paper (*loc. cit.*) regarding the 4-dibromo-1-methyl*cyclo*hexyl-4-acetic acids; it reads: "For purposes of classification, therefore, it is

...venient to regard the dibromides as exhibiting two elements of asymmetry, namely, a centroasymmetry exhibited by the right-hand part of the configurations of Figs. 1, 2, and 3, and an asymmetry of the carbon atom (7), as is shown in Figs. 2 and 3."

There are many reasons why the classification suggested in this quotation should not be adopted, amongst them being the following:

There is no centroasymmetry exhibited by the *right-hand* part of the configuration of Fig. 1, for if everything right of carbon atom (1) be included, the configuration is symmetric about the plane of the ring. That the asymmetry of the *whole* of the configuration is traceable to the asymmetry of carbon atom (1) has been discussed above.

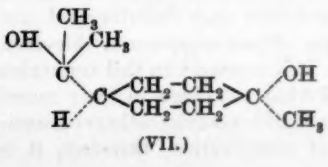
In Figs. 2 and 3 likewise, neither the *right-hand* nor the *whole* of the configurations show any asymmetry that is not traceable to carbon atom (7), and which is not destroyed when the asymmetry of that atom [carbon atom (7)] is destroyed.

Neither is it now possible to defend the system on the ground that it is but the counterpart of that by which many lævorotatory compounds are designated dextro, by reason of their having been derived from a dextro-parent substance—and vice versa—for the parent substance (1-methyl*cyclo*hexylidene-4-acetic acid) cannot now be looked upon as being "centroasymmetric."

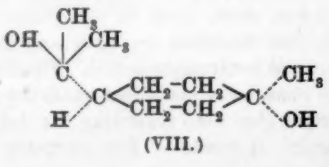
As mentioned above, in all these dibromo-compounds described by Perkin and Pope, and illustrated by them in Figs. 2 and 6 (*loc. cit.*), the asymmetry of the molecule is traceable to the carbon atom (7) and disappears with it.

In reality these bromo-derivatives are merely cases of *cis*- and *trans*-isomerism of cyclic compounds through the first instance of the isolation of the different optical isomerides derived therefrom.

Thus, *cis*-terpin (VII) and *trans*-terpin (VIII) are quite similar instances of this, and, moreover, although neither of these can be said to be centroasymmetric, yet by replacement of one of the methyl groups in the system by another group (not OH), then there are possible exactly similar isomerides as those discussed above—*d*- and *l-cis* and *d*- and *l-trans*—yet here, also, the asymmetry is entirely traceable to the asymmetric carbon atom thus produced.



(VII.)



(VIII.)

307. "**Nitrites of the alkylammonium series. Part II. Propylammonium nitrite and butylammonium nitrite and their decomposition by heat.**" **By Prafulla Chandra Rây and Jitendra Nath Rakshit.**

Propylammonium nitrite decomposes when heated mainly into nitrogen, *iso*propyl alcohol, and water; small quantities of nitrosodipropylamine and in some cases nitric oxide and propylamine were also detected.

Butylammonium nitrite when heated decomposes into nitrogen and *iso*butyl alcohol.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Clowes, *Frank*, and **Coleman**, *Joseph Bernard*. Quantitative chemical analysis. 9th edition. pp. xxiv + 565. ill. London 1911. (*Recd.* 11/11/11.) From the Publishers: Messrs. J. & A. Churchill.

Friend, *John Albert Newton*. Elementary domestic chemistry. pp. x + 180. ill. London 1911. (*Recd.* 17/10/11.) From the Author.

Indian Guild of Science and Technology. Year Book 1911. pp. 135. ill. Letchworth 1911. (*Recd.* 11/11/11.) From the General Secretary

Local Government Board. Reports of Inspector of Foods. Nos. 1 to 16. London 1906–1911. (*Reference.*) From the Inspector of Foods.

Senter, *George*. Text-book of inorganic chemistry. pp. x + 583. ill. London 1911. (*Recd.* 4/11/11.) From the Author.

II. *By Purchase.*

Glikin, *W.* Kalorimetrische Methodik. Ein Leitfaden zur Bestimmung der Verbrennungswärme organischer Körper, einschliesslich Nahrungsstoffe und Stoffwechselprodukte und zur Messung der tierischen Wärmeproduktion. pp. vii + 208. ill. Berlin 1911. (*Recd.* 9/11/11.)

Worden, *Edward Chauncey*. Nitrocellulose industry. A compendium of the history, chemistry, manufacture, commercial application and analysis of nitrates, acetates and xanthates of cellulose. . . . With a chapter on guncotton, smokeless powder and explosive cellulose nitrates. 2 vols. pp. xxxiv + 566, xxviii + 567 to 1239. London 1911. (*Recd.* 14/11/11.)

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 4th, 1911.

All persons who received grants in December, 1910, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Friday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

VAN'T HOFF MEMORIAL.

Subscriptions to this fund (see this vol., p. 272) will be received by the Treasurer of the Society (Dr. Alexander Scott).

At the next Ordinary Scientific Meeting on **Thursday, December 7th, 1911, at 8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Chemical examination of the root of *Ipomosa orizabensis*." By F. B. Power and H. Rogerson.

"The constitution of ergothioneine, a betaine related to histidine." By G. Barger and A. J. Ewins.

"The methane equilibrium." By J. N. Pring and D. M. Fairlie.

"The absorption of the halogens by dry slaked lime." By W. A. R. Wilks.

"The decomposition of nitric acid by light." By W. C. Reynolds and W. H. Taylor.

"Note on the presence of iodic acid in commercial pure nitric acid." By W. C. Reynolds and W. H. Taylor.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

following Candidates have been proposed for election. A ballot will be held on December 7th, 1911.

Bescoby, Arthur Cecil,

Guestling, Hastings.

Science Master and Public Analyst. Camb. Nat. Sci. Tripos, 1908, 1st Class; Scholar and Prizeman, Emmanuel College: Inter-Collegiate Exam. 1907, 1st Class; Sci. Master, Hastings Grammar School, 1908–1911. Senior Sci. Master, Elizabeth College, Guernsey; States Analyst and Lecturer in Agricultural Chemistry to States of Guernsey; Author of "Elementary Course of Practical Chemistry," etc.

F. Gowland Hopkins. J. Ll. Davies.
S. Allinson Woodhead. W. R. R. Starling.
F. H. Neville.

Bull, Bertram Alfred,

Government Road, Nairobi, British East Africa.

Pharmaceutical Chemist. Silver Medallist, Chemistry, London College of Pharmacy, 1906; Minor and Major Examinations, Pharmaceutical Society; Pereira Medallist, Pharmaceutical Society, 1907.

F. G. P. Remfry. H. A. D. Jowett.
H. C. Sayer. W. C. Reynolds.
Frederic H. Lees.

Bull, Joseph Beauchamp,

Bulawayo.

Chemist and Assayer. Three years' course in Assaying and Chemistry at the Government School of Mines, Sale, Victoria, Australia. Four years in Chemists and Assayers Department Simmer and Jack Mine, Johannesburg. Ten years' practice with Mr. G. A. Pingstone, F.C.S., Member of Society of Public Analysts, Member of Royal Sanitary Institute.

Harold B. Dixon. Charles Estcourt.
Geo. A. Pingstone. James C. T. Pollitt.
C. G. Moor.

Charlton, Edwin Johnson, M.Sc.,

Morannedd, Beaumaris, North Wales.

Science and Second Master, The Grammar School, Beaumaris, North Wales. Teacher of Chemistry at the above Institution, M.Sc. (Chemistry) Manchester University. Desires to keep in touch with modern progress in the subject.

Harold B. Dixon. Norman Smith.
W. H. Perkin. E. C. Edgar.
Ch. Weizmann. *Arthur Lapworth.*

Dutt, Prof. Barun Chandra, M.A.,

"Rambagan Cottage," Rambagan, Calcutta.

Professor, Scottish Churches College, Calcutta. Passed M.A Exam. in Chemistry (Calcutta University) in 1893. Formerly Professor of Chemistry in the Calcutta Central College and Metropolitan Institution. At present Professor of Chemistry in the Scottish Churches College, Calcutta.

Punchānan Neogi. P. C. Rây.
Jyoti Bhushan Bhaduri. *Bidhu Bhushan Dutta.*
John Watt.

Garner, John Henry,

Sewage Works, Deighton, Huddersfield.

Chemist in Charge, Sewage Disposal Works, Huddersfield. B.Sc., London, 3rd Class Honours in Chemistry, 1906. From March, 1907, to November, 1911, Chemical Assistant on the laboratory staff of the West Riding Rivers Board, Wakefield.

Arthur Smithells. H. M. Dawson.
J. B. Cohen. H. T. Calvert.
W. E. Speight.

Gauge, Arthur Josiah Hoffmeister,

2, Ashford Avenue, Hornsey, London, N.

Analyst, Government Laboratory, London, W.C. Student at Royal College of Science, S. Kensington, 1902–4; now at the Government Laboratory, Clement's Inn Passage, W.C.; author. See *Transactions*, Chemical Society, 1910, p. 377; 1911, pp. 683, 1075, 1615.

James J. Dobbie. Geo. Stubbs.
E. Grant Hooper. J. J. Fox.
P. J. Sageman.

Gaunt, Rufus,

70, Abingdon Villas, Kensington, W.

Senior Assistant, Scientific Department, Imperial Institute. M.Sc.,

Leeds; Ph.D., Berlin. Formerly Lecturer in Agricultural Chemistry, University College of North Wales.

Arthur Smithells. Thomas A. Henry.
J. B. Cohen. Ernest Goulding.
Sam. S. Pickles.

Hall, Sydney,

Birley House, Station Road, March, Cambs.

Senior Science Master and Lecturer in Chemistry at the Grammar School, March. Bachelor of Science of the Manchester University, taking Chemistry in the Final Exam. (1906). Twelve years' experience as a student and lecturer in Chemistry. Five years' experience as lecturer in Chemistry and Director of Chemical Laboratories.

Harold B. Dixon. Norman Smith.
W. H. Perkin. E. C. Edgar.
Ch. Weizmann. *Arthur Lapworth.*

Hodgson, Cyril Vincent,

80, Apedale Road, Chesterton, Staffs.

Analytical Chemist for Midland Coal, Coke, and Iron Co., Ltd. Certificates in Adv. Iron and Steel Manufacture and Chemistry Educated at the Middlesbrough High School. Five years' experience in Iron and Steel Works Laboratory, and Coke Works at Middlesbro', under Mr. C. H. Ridsdale; and for past two years Head Chemist for Midland Coal, Coke, and Iron Co., Staffs.

C. H. Ridsdale. W. M. Hooton.
J. E. Stead. *Ernest W. Jackson.*
R. B. Wight. *A. C. Wilson.*

Hodsman, Henry James,

2, Richmond Hill, Langley, nr. Birmingham.

Technical Chemist (British Cyanides Co., Ld., Oldbury). M.Sc. Leeds. 1851 Exhibition Science Scholar. Two years with Prof. F. Haber, Technische Hochschule, Karlsruhe; one year with Prof. H. Le Chatelier, La Sorbonne, Paris. Publications (with J. B. Cohen), "Influence of Substitution in the Nucleus on the Rate of Oxidation in the Side-chain" (*Trans.*, 1907, vol. 91, p. 970); (with F. Haber), "Die Zusammensetzung der Gase in sehr heissen Flammen" (*Zeit. Phys. Chem.*, 1909, vol. 67, 3, p. 343).

Arthur Smithells. Harry M. Dawson.
Julius B. Cohen. J. E. Coates.
Edmund C. Rossiter.

Hogg, Alexander Frederick,

81, Claremont Road, Forest Gate, E.

Principal of the West Ham Municipal Technical Institute. M.A.Cantab. (Natural Sciences Tripos); late Head of Chemical Department and Director of Studies at the Technical College, Darlington.

Raphael Meldola. George Dean.
F. H. Neville. J. Wertheimer.

F. Henry Streatfeild.

Khosla, Sant Ram,

Near City Kotwali, Lahore (India).

Student. Has been a Student in the Chemical Department of the Manchester School of Technology, Manchester, for four years. Recently obtained the Final Certificate in Chemical Technology of the Victoria University, Manchester. Had previously passed the Inter. Arts Exam. of the Punjab University, and other Exams.

Edmund Knecht. Stanley J. Peachey.
James Grant. F. S. Sinnatt.

Fred. G. Richards.

King, Harold, M.Sc.,

161, Altmore Avenue, East Ham, E.

Chemist with the Gas Light and Coke Co., Beckton, and holder of an Industrial Bursary (1851 Royal Commissioners). Joint-author of (I) "Purification of Acetic Acid," *Trans.*, 1911, 1178; (II) "A Method of Chlorination, Chlorination of Anilines and Phenols," *Trans.*, 1911, 1185; (III) "The Relation of the Velocity of Chlorination of Aromatic Compounds to Constitution. Part I. Chlorination of Anilides," *Trans.*, 1911, 1369; (IV) "The Chlorination of Acylanilides. Effect of the Constitution of the Acyl Group on the Proportion of the Ortho and Para Derivatives," *Trans.*, 1911, 1377.

Kennedy J. P. Orton. H. O. Jones.
Walter W. Reed. J. E. Coates.

W. J. Wilson.

Martin, Geoffrey,

4, Bertram Road, Hendon, London, N.W.

Science Teacher and Industrial Chemist. B.Sc. (Lond.), M.Sc. (Bristol); Ph.D. (Rostock); Recognised Teacher of London University; Lecturer on Chemistry at the Birkbeck College, London; formerly Lecturer and Demonstrator in Chemistry at the University College, Nottingham. Author of following books: (1) "Researches on the Affinities of the Elements"; (2) "Practical Chemistry for Matriculation and Army Candidates"; (3) "Triumphs and Wonders of Modern Chemistry." Joint-author with Prof. Kipping, F.R.S., of two papers in

Trans. Chem. Soc., namely, (1) "Action of Fuming Sulphuric Acid on Triphenylsilicol, [95, (1909)]"; (2) "Benzyl and Ethyl Derivatives of Silicol Tetrachloride (1909)"; Author of about fifty papers in *Journal of Physical Chemistry*, *Chemical News*, *Knowledge*, *Nature*, *Science*, *Gossip*, etc., etc.

F. Stanley Kipping. Frederick Challenger.
R. M. Caven. Alex. McKenzie.
Henry J. S. Sand. G. W. Clough.

Robert Robison.

Mills, Robert,

Plantation Uitolugt, W.C. Demerara, British Guiana.

Analytical Chemist. Two years Pharmaceutical work; six years Public Analysts' Laboratory, Greenock; five years Sugar Refinery work Greenock and Bristol, and nine and a half years Sugar Factory work India and Demerara.

John Wm. Biggart. Jno. Williams.
Angus Smith. William Douglas.
J. B. Harrison. *Alleyne Leechmann.*

John Young.

Nath, B. Viswa,

Vizianagaram City.

Chemist to the Rajah of Tuni, Tuni, Madras Presidency, India. Founder, Proprietor, and Manufacturing Chemist, Industrial Laboratory, Vizianagram; Assistant Chemist, Bobbili Mining Company; Chemist to the Rajah of Tuni, and is prepared to edit a Scientific Journal shortly.

P. C. Rây. M. Goolab Roy.
Lakshami Chand. *A. K. Sen.*

James W. Anderson.

Parkes, Thomas Peers,

22, Dalrymple Road, Brockley, S.E.

Manager of Chemistry Department, J. J. Griffin & Sons, Ltd., Kingsway, W.C. B.Sc. (London). Studied Chemistry at Goldsmiths' College, New Cross, S.E.

Arthur Lapworth. James D. Kettle.
C. Edwd. Sage. John Ward Stainer.

Frank E. Weston.

Peacock, David Henry,

40, Huddart St., Bow, London, E.

Research Student, Trinity College. First Class Nat. Sci. Tripos, 1910, (Pt. I), and 1911 (Pt. II, Chemistry). 2nd Class Honours,

B.Sc., London, 1910 (External). Senior Scholar, Trinity College. Research Student in the University Laboratory.

William J. Pope. H. J. H. Fenton.
W. J. Sell. Charles T. Heycock.
H. O. Jones. F. E. E. Lamplough.

Rao, B. Venkata,

Bangalore, Mysore, India.

Assistant Chemist, Government of Mysore. Graduate in Chemistry of the Madras University (1893). Assistant Chemist, Mysore Government, doing Analytical Work for the Geological and Agricultural Departments since 1895. From October, 1909, in Germany on Deputation to Study Agricultural Chemistry.

Harold Moore. Frederick Challenger.
O. Wallach. *W. N. Haworth.*
J. F. McGregory. *A. Jamieson Walker.*

Raymond, Percy James,

20, Arboretum Road, Worcester.

Analytical Chemist. Food, Drug and General Analyst. Seven years Assistant to Mr. R. H. Harland, F.I.C., Public Analyst, 37, Lombard Street, London. Then: Assistant to Messrs. Harland and Brown (successors to Mr. R. H. Harland), Consulting Chemists and Public Analysts. Then and now: Assistant to Mr. C. C. Duncan, F.I.C., Shirehall, Worcester, County and City Analyst for Worcestershire.

Cecil Duncan. H. J. Aubrey.
R. A. Warren. *J. Stewart Rimington.*
Claude Smith.

Reilly, Joseph,

25, S. Circular Road, Portobello, Dublin.

B.A. (Hons.) National Univ. Ireland. Associate of Royal College of Science, Ireland (in Applied Chemistry). Holder of Scholarship (4th year) in Royal Coll. of Science. Associate of Royal Coll. of Science, Ireland (in Applied Chemistry). Honours Graduate National Univ. of Ireland (in Chemistry and Physics). Assistant Teacher at Depts. of Agriculture and Tech. Inst. (Ireland), Summer Course, 1911, (4th year Chemistry) for Secondary Teachers. Holder of Research Scholarship (in Chemistry), in R.C. Sc., Dublin, Session 1911–12.

A. O'Farrelly. W. N. Hartley.
James H. Pollok. George A. Watson.
P. Bertram Foy.

Ridsdale, Noël Douglas,

Ravenscroft, Roman Rd., Middlesbrough.

Analytical and Metallurgical Chemist. Several years since as

Student passed Senior, Cambridge; also gained certificates in Advanced Iron and Steel Manufacture and Chemistry. Seven years' experience in the North-Eastern Steel Co.'s Iron, Steel, and Coke Oven Laboratories, during which went through special course of Chemical and Metallurgical training under Mr. C. H. Ridsdale, F.I.C., F.C.S., etc. Special Research in connexion with analytical methods—designing new ones. Joint author of Paper before Iron and Steel Inst., on "Mechanicalising Analysis."

W. Gowland. J. E. Stead.
H. Frankland. W. H. Merrett.
Ernest W. Jackson. *Harold E. Wright.*

E. H. Saniter.

Saville, William Bristow,

117, Vassall Road, Brixton, S.W.

Analytical Chemist; 4½ years pupil to Mr. F. W. Richardson, F.I.C., etc., Analyst to the West Riding of Yorkshire. Assistant to Messrs. Harland and Brown, Analytical Chemists, Lombard Street, E.C., since May, 1910.

R. M. Harland. Wm. Keighley Walton.
F. W. Richardson. *A. B. Knaggs.*
A. Jaffé. *Saml. F. Stell.*

J. W. Pallister.

Scopes, Lionel Gowing-,

3, Estcourt Street, Devizes, Wilts.

Analytical Chemist. Trained City and Guilds Tech. College, Finsbury. Author of "The Estimation of Tartaric Acid in the Presence of Malic and Succinic Acids," *Analyst*, August 1908; "The Uses of Trichlorethylene in Analytical Chemistry," *Analyst*, June 1910. Analyst to Wilts United Dairies, Devizes, Wilts. Late Assistant Research Lab. Mond Nickel Works, Swansea.

H. Droop Richmond. F. W. Harbord.
A. Chaston Chapman. F. Henry Streatfeild.

R. Meldola.

Smith, Bernard Charlie,

62, Filey Avenue, Upper Clapton, N.E.

Analytical Chemist. Apprentice for three years under Public Analyst. Chief Chemist at Welsbach Incandescent Mantle Co.

Roland J. May. Percy Edgerton.
W. M. Seaber. *Edwin M. Eagles.*

Thomas H. Pope.

Smith, John Henry,

10, Radnor St., Swindon, Wilts.

Analytical Chemist, G.W.R. Laboratory. The qualification is a large and varied experience in analytical work. The reason is that having secured appointment as Analytical Chemist to the Central Argentine Railway, I am very desirous of keeping in touch with advance in chemical science.

W. R. Bird. Thomas Hartley.
T. C. Davison. *J. H. B. Jenkins.*
L. Archbutt.

Stokes, George Alfred,

60, Parkhill Road, Hampstead, N.W.

Assistant to A. W. Stokes, F.I.C., F.C.S., Public Analyst. Student of City and Guilds Tech. College, Finsbury for four years, and obtained certificate. Student at Sir John Cass Tech. Institute. Student of Institute of Chemistry.

Alf. W. Stokes. H. Burrows.
R. Meldola. R. Bodmer.
Charles A. Keane. André Bracher.

Vakil, Kapibram H.

5, Santa Cruz, Bombay.

Chemist. Bachelor of Arts in Chemistry and Physics (Bombay University). Honours in Oils and Fats, City and Guilds of London. Bachelor of Technical Science (Victoria University).

Edmund Knecht. F. G. Richards.
Jas. Grant. S. J. Peachey.
F. S. Sinnatt.

Vanstone, Ernest,

Gwynfe House, Mount Pleasant, Neath, Glam.

Research Student. B.Sc. (Wales) with 1st Class Honours in Chemistry; 1851 Exhibition Research Scholar. Formerly "Isaac Roberts" Research Scholar, and Glamorgan Free Student, University College, Cardiff. Author of (1) "The Miscibility of Solids," *J.C.S.*, 1909; (2) "The Vapour Pressures of Solids and Solid Solutions," *J.C.S.*, 1910; (3) "A Physico-chemical Study of Mercury-Sodium Alloys," *Trans.*, Faraday Society, 1911.

William Ramsay. T. P. Hilditch.
R. Whytlaw-Gray. W. C. McC. Lewis.
N. T. M. Wilsmore.

Vipond, Harry James,

Department of Agriculture, Pretoria, South Africa.

Assistant Chemist, Agriculture Department, Union of South

Africa. B.A. and Diploma in Agriculture, University of Cambridge, six months as assistant in the laboratory of Dr. Bernard Dyer, in London, six months at the Rothamsted Experiment Station, two years in present position.

T. B. Wood. A. Hutchinson.
Bernard Dyer. H. O. Jones.
H. J. H. Fenton.

Wishart, George,
Royal School, Armagh.

Science Master. Late Science Scholar of Jesus College, Oxford, B.A. (Hons. in Final Chemistry Schools).

Harold Hartley. D. L. Chapman.
N. V. Sidgwick. H. B. Baker.
A. F. Walden.

Wright, Ernest Walter,
Connaught Club, Seymour Street, London, W.

Analytical Chemist. Chief Assistant to A. W. Stokes, Esq., F.I.C., Public Analyst. Student at the "Sir John Cass Technical Institute."

Alf. W. Stokes. Charles A. Keane.
Cecil Revis. H. Burrows.
André Bracher.

The following Certificates have been authorised by the Council for presentation to Ballot under Bye-law I (3):

Gardthausen, Charles Christian,
Pretoria.

Assistant Curator, Geological Survey, Transvaal. Assayer and Chemical Assistant to the Geological Survey, Transvaal, 1903 to date. Student under Mr. Castell Evans at the City and Guilds Institute, Finsbury, 1888–1889. Assayer to: the Jubilee G.M. Co., Van Ryn Estates G.M. Co., and George Goch G.M. Co., from 1889 to 1899.

A. Hutchinson. *J. A. Wilkinson.*

Hill, James Hogan,
c/o Opium Agent, Ghazipur, U.P., India.

Opium Department. Student of the Royal College of Science, London, during the Session 1904–1905. Passed examinations in Inorganic and Organic Chemistry, and made a special study of the chemical analysis of opium under Professor Tilden.

E. R. Watson. G. T. Morgan.
William Tate. *G. O'B. Power.*

Nilié-Martin, Gaston,

South Coast Junction, Natal.

Chief Chemist to the South African Sugar Refineries, Ltd. Analytical Chemist on various sugar estates, chemical manure factories, assay laboratories, refineries, etc.

T. H. P. Heriot. James A. H. Armstrong.

Richardson, John Ffraid,

Government Quinine Factory, Mungpu, P.O., Sonada, Darjeeling Himalayan Railway, India.

Assistant Quinologist to the Government of Bengal. Member of the Pharmaceutical Society. At present engaged in the manufacture of cinchona alkaloids, analysis of cinchona bark and its alkaloids, and research work on the same.

G. E. Shaw.

Vassiliev, Alexey Mĭkhaĭlovich,

Russia, Kasan, Chemical Laboratory of University.

Privat-docent at the University of Kasan; Assistant in the Chemical Laboratory of the Veterinary Institute; Secretary of the Technical Department of the Imperial Economical Society of Kasan. Member of Russian Physico-Chemical Society; of the Society of Naturalists of the University of Kasan; and of the Imperial Economical Society of Kasan. Author of 8 papers printed in the *Journal of the Russian Physico-Chemical Society*, and of 10 papers printed in the *Scientific Memoirs of the University of Kasan.*

F. M. Flavitzky. D. K. Dobrosserdov.

A. J. Bogorodsky. *Horace T. Brown.*

R. CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK

[*Issued* 15/12/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 393.

Thursday, December 7th, 1911, at 8.30 p.m., Dr. M. Onslow Forster, D.Sc., Ph.D., F.R.S. (Vice-President), in the Chair.

Mr. F. Thomas was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

Hilmar Johannes Backer, D.Chem., 4, Upper Bedford Place, W.C.
Ernest Arthur Bearder, M.Sc., Mayfield, Wythenshawe Road, Sale.
Gibbs Blackstock, B.A., 79, Prince Arthur Avenue, Toronto.
Frederic Fernandez Curtis, 20, Bury Street, Bloomsbury, W.C.
Rowland Holliday Ellis, Hope Cottage, Brayton Road, Selby.
Thomas Sidney Haines, 73, Kennington Avenue, Bristol.
William McMillan, 72, Wellington Street, Greenock.
Ernest Meyer Myers, c/o The Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent.
William Johnson Smith Naunton, B.A., B.Sc., 1, New Street, Woodbridge.
James Pettigrew Ogilvie, Homedale, Hendon Lane, Finchley, N.
William Raitt, Dehra Dun, N.P., India.
Walter Morrell Roberts, M.Sc., The Cedars, Whalley Range, Manchester.

Bertram James Smart, B.Sc., Testing Office, Lithgow, N.S.W.
Cecil Hamersley Waldron, 28, Hungerford Road, Camden Road, N.
John Charles Withers, Ph.D., 83, Edgeley Road, Clapham, S.W.

A ballot for the election of Fellows was held, and the following were declared subsequently duly elected:

Arthur Cecil Bescoby, B.A.
Bertram Alfred Bull.
Joseph Beauchamp Bull.
Edwin Johnson Charlton, M.Sc.
Barun Chandra Dutt, M.A.
Charles Christian Gardthausen.
John Henry Garner, B.Sc.
Arthur Josiah Hoffmeister Gauge.
Rufus Gaunt, M.Sc., Ph.D.
Sydney Hall, B.Sc.
James Hogan Hill.
Cyril Vincent Hodgson.
Henry James Hodsman, M.Sc.
Alexander Frederick Hogg, M.A.
Sant Ram Khosla.
Harold King, M.Sc.
Geoffrey Martin, M.Sc., Ph.D.
Robert Mills.
Bhâgavatula Viswa Nath.
Gaston Nilié-Martin.
Thomas Peers Parkes, B.Sc.
David Henry Peacock, B.A., B.Sc.
B. Venkata Rao, B.A.
Percy James Raymond.
Joseph Reilly, B.A.
John Ffraid Richardson.
Noël Douglas Ridsdale.
William Bristow Saville.
Lionel Gowing-Scopes.
Bernard Charlie Smith.
John Henry Smith.
George Alfred Stokes.
Kapibram Hardevram Vakil, B.A.
Ernest Vanstone, B.Sc.
Alexey Mikhaïlovich Vassiliev.
Harry James Vipond, B.A.
George Wishard, B.A.
Ernest Walter Wright.

Of the following papers, those marked * were read:

***308. "Chemical examination of the root of Ipomoea orizabensis." By Frederick Belding Power and Harold Rogerson.**

The material employed for this investigation consisted of the root of *Ipomoea orizabensis*, Ledanois (Nat. Ord. *Convolvulaceae*), commonly known as "Mexican Scammony Root."

The root contained 14·55 per cent. of resin, 71 per cent. of which was soluble in ether. After purification with animal charcoal, the resin was obtained nearly colourless. It then melted at 125—130°, and had $[\alpha]_D$ −23·0°.

For a complete examination of the root, 48·76 kilograms of the ground material were extracted with hot alcohol. The resulting extract, when distilled in a current of steam, yielded a small amount of a pale yellow essential oil.

From the portion of the extract which was soluble in water the following compounds were isolated: (i) scopoletin, $C_{10}H_8O_4$; (ii) 3:4-dihydroxycinnamic acid, $C_9H_8O_4$, from which the *methyl* ester (m. p. 158—160°) was prepared. The aqueous liquid con-

tained, furthermore, a quantity of sugar, which yielded *d*-phenylglucosazone (m. p. 205—206°), and from a portion of the original alcoholic extract a small amount of sucrose was also obtained.

The portion of the alcoholic extract which was insoluble in water consisted of a resin which possessed the above-mentioned characters. This resin, by successive extraction with various solvents, was resolved into a number of products which were for the most part amorphous, and not entirely glucosidic, but by the further treatment of these products many well-defined substances were obtained. It has thus been shown that the resin is exceedingly complex in character, and it follows that the so-called "jalapin," which includes all those constituents of the resin which are soluble in ether, cannot be represented by any of the various formulæ hitherto assigned to it.

***309. "The constitution of ergothioneine: a betaine related to histidine." By George Barger and Arthur James Ewins.**

Ergothioneine, $C_9H_{15}O_2N_3S$, a crystalline base isolated from ergot by Tanret in 1909, has been found to be a betaine of thiolhistidine (α-amino-β-2-thiolglyoxaline-4(or 5)-propionic acid).

On boiling with 50 per cent. aqueous potassium hydroxide trimethylamine is eliminated, and an acid, $C_6H_6O_2N_3S$ (β-2-thiolglyoxaline-4(or 5)-acylic acid), is obtained. On oxidation with dilute nitric acid the latter yields β-glyoxaline-4(or 5)-acrylic acid, from which on reduction β-glyoxaline-4(or 5)-propionic acid is produced.

The treatment of ergothioneine with ferric chloride leads to the formation of histidine-betaine.

***310. "The methane equilibrium." By John Norman Pring and Dorian Macefield Fairlie.**

Carbon was heated electrically in hydrogen at definite known temperatures between 1100° and 2000°, and under pressures between 10 and 200 atmospheres. The velocity of the formation of methane was found to increase rapidly with the pressure, and to proceed to a final equilibrium stage.

As would follow from the law of mass action for a true equilibrium, the value of $p\text{-}CH_4/p\text{-}(H_2)^2$ was always found to be constant under different pressures if the temperature were the same, and the same modification of carbon used.

With amorphous carbon, temporary equilibrium values were obtained, in which at all temperatures the amount of methane was greater than that corresponding with the true equilibrium

with graphite. The relative difference between the equilibrium values for amorphous carbon and graphite increases with the temperature. It follows from this, by applying Kirchhoff's law, that the mean specific heat of amorphous carbon is, at all the temperatures concerned in this work, higher than that of graphite, and that the difference increases with the temperature.

No appreciable effect was exerted by high pressures on the yield of acetylene and ethylene, and no other hydrocarbon was formed.

*311. "The decomposition of nitric acid by light."
By William Colebrook Reynolds and William Henry Taylor.

The authors have investigated the decomposition of nitric acid by light, and find that the reaction is reversible, the products of decomposition slowly recombining more or less completely in the absence of light. The extent of the decomposition and recombination was illustrated by a series of curves. They have proved that pure anhydrous nitric acid decomposes very slowly in the dark, giving the same products of decomposition.

Discussion.

Dr. Veley expressed his satisfaction that the authors had amply confirmed the conclusion drawn from certain elementary experiments by Manley and himself (*Phil. Trans.*, 1908, *A*, **191**, 367) that the vapour of nitric acid rather than the liquid is decomposed by sunlight. The observations of the authors that the reaction, $4HNO_3 = 2H_2O + 2N_2O_4 + O_2$, is reversible on alteration of conditions, appeared to be of especial interest, and was in accordance with results obtained in the study of other reactions in which nitric acid took part.

More information might possibly have been obtained from the authors' results if sunshine records had been given; although it was shown that the actinic effect of the sun was greater in August than in May, a result to be expected, yet the difference found between the effects in May and March was almost inappreciable, a result contrary to general experience.

Professor T. Turner asked for information as to the method whereby the pressure in the tubes had been estimated, and how the gases were collected and measured. It was also suggested that by means of a capillary tube closed at the upper end and inserted inside the closed tube, a continuous series of pressure observations might perhaps be taken, instead of only determining the final pressure at the end of the test.

Dr. SCOTT asked whether the authors had considered the possibility of traces, especially of hydrochloric acid and of iron, acting as catalysts. These and other substances which might act thus might conceivably come from the glass apparatus used.

The curves of the pressures obtained with the various proportions of liquid and vapour space were remarkable in the case of a reversible action.

Mr. REYNOLDS, in reply to Dr. Scott, stated that it was possible that traces of iron and chlorine too small to be detected by the ordinary reagents were present in the acid employed through contact with glass. If such traces affected the results, it was, however, curious that the phenomena were so regular when different samples were employed, and that in clear silica tubes rather greater decomposition occurred than in glass; moreover, as only the vapour was decomposed, it was unlikely that iron affected the phenomena.

***312. "Derivatives of *o*-xylene. Part I. 3-Nitro-*o*-xylene and 3:6-dinitro-*o*-xylene." By Arthur William Crossley and Gertrude Holland Wren.**

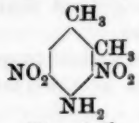
3-Nitro-*o*-xylene has been prepared from 3:4-dinitro-*o*-xylene by reduction with stannous chloride to 3-nitro-*o*-4-xylidine, and replacement of the amino-group in this substance by a hydrogen atom. A comparison of the properties of 3-nitro-*o*-xylene obtained in this way with the 3-nitro-*o*-xylene isolated from the products of the action of a mixture of nitric and sulphuric acids on *o*-xylene (*Trans.*, 1909, **95**, 208) shows that the latter contains some of the isomeric 4-nitro-*o*-xylene, probably about 7 per cent.

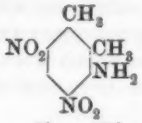
3:6-Dinitro-*o*-xylene (compare *Trans.*, 1909, **95**, 210) has now been obtained in a pure condition from the products of direct nitration of *o*-xylene. It crystallises from alcohol in sheaves of needles, melting at 89—90°.

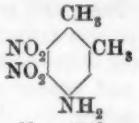
***313. "Derivatives of *o*-xylene. Part II. Dinitro-*o*-xylidines." By Arthur William Crossley and George Francis Morrell.**

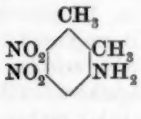
Attempts to prepare 3:6-dinitro-*o*-xylene by conversion of 3:4:6-trinitro-*o*-xylene into 3:6-dinitro-*o*-4-xylidine and elimination of the amino-group from this substance have been unsuccessful. The nitro-group in position 3 is the one attacked by reducing agents.

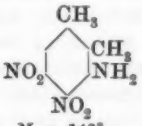
In the course of the experiments five of the six theoretically possible dinitro-*o*-xylidines have been prepared, and their properties

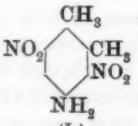

M. p. 143°.


M. p. 161°.


M. p. 210°.


M. p. 172°.


M. p. 143°.


(I.)

were described. The missing 3:6-dinitro-*o*-4-xylidine (I) is the one which it was desired to prepare for the initial object of this research.

Discussion.

Dr. Morgan drew attention to the interesting analogy existing between the interaction of alcoholic ammonia and 3:4:5-trinitro-*o*-xylene and 3:4:6-trinitro-*o*-xylene, whereby the mobile nitro-groups (4-NO_2 and 3-NO_2 respectively) were replaced by amino-groups, and the formation of aromatic amines from 1-chloro-2:4-dinitrobenzene or 1:2:4-trinitrobenzene, in which a mobile chloro- or nitro-radicle is directly replaced by an amino-group. This extreme mobility of the chloro- or nitro-radicle was conditioned by the presence of two other nitro-groups in ortho-para- or di-ortho-positions with respect to the reactive substituent (compare Hepp, *Annalen*, 1882, **215**, 363).

314. "The absorption of the halogens by dry slaked lime." By William Arthur Reginald Wilks.

It was shown that bromine is absorbed from carbon tetrachloride solution by slaked lime (dried in a vacuum), with the production of an "adsorption compound," which is brick-red. The colour of "bromine bleaching powder" is due to this product. Iodine gives a similar adsorption compound, which is almost black.

The concentrations of bromine in the solution (C_2) and in the lime (C_1) are connected by the formula $\frac{C_1}{C_2^n} = k$, when n is one-third. The adsorption of iodine obeys a similar formula, n being still one-third, but the constant k has a value different from that of bromine.

Adsorption phenomena could not be detected when chlorine was absorbed by dry slaked lime under the same conditions as before, but the results showed that in this case a chemical compound was formed.

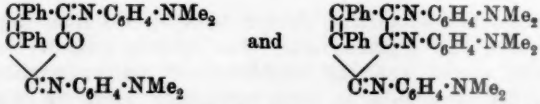
315. "A method of determining carbon and nitrogen in organic compounds." By Edward Percy Frankland.

With reference to the author's method for the simultaneous determination of carbon and nitrogen in organic substances (*Trans.*, 1911, **99**, 1783), his attention has been drawn to the fact that similar determinations were made by Klingemann (*Annalen*, 1893, **275**, 92), using a gas apparatus for the estimation of nitrogen and carbon dioxide. Whilst aware that Dr. Klingemann had carried out an investigation on the production of nitric oxide during the combustion of nitrogenous substances in a vacuum (*Ber.*, 1889, **22**, 3064), the author regrets that he was not previously cognisant of the fact that determinations of carbon in organic compounds had been made by the Frankland-Armstrong process, and that, therefore, he was unable to make reference to Dr. Klingemann's second communication on this subject.

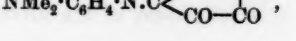
The author considers that the principal advantage of the process as described by him lies in the avoidance of all complicated apparatus for gas analysis, thus rendering the method of more general utility.

316. "Diphenyl*cyclo*pentenone." By Siegfried Ruhemann and William Johnson S. Naunton.

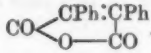
With the view of preparing cyclic triketones with three adjacent ketonic groups similar to triketohydrindene, 3:4-diphenyl*cyclo*pentenone (Japp and Lander, *Trans.*, 1897, **71**, 131) was treated with *p*-nitrosodimethylaniline. This reaction yields two condensation products with two and three dimethylaminoanilo-groups respectively:



Both compounds on hydrolysis with mineral acids yield *5-dimethylaminoanilo-3:4-diphenyl*cyclo*pentene*-1:2-dione*:



which on heating with concentrated hydrochloric acid at 130—140° forms diphenylmaleic anhydride:



5-Dimethylaminoanilo-3:4-diphenyl*cyclo*pentene-1:2-dione when treated with bromine gives a yellow *bromo*-derivative,

$$C_{25}H_{19}O_2N_2Br,$$

but with an excess of the halogen an unstable *perbromide* is produced, which on boiling with alcohol decomposes to yield the same yellow monobromo-derivative along with a scarlet *dibromo*-compound, $C_{25}H_{18}O_2N_2Br_2$.

With fuming nitric acid the substance forms a scarlet *dinitro*-derivative, $C_{25}H_{18}O_2N_2(NO_2)_2$; on reduction with zinc dust and acetic acid it furnishes a colourless compound, $C_{25}H_{22}O_2N_2$.

5-Dimethylaminoanilo-3:4-diphenyl*cyclo*pentene-1:2-dione is deep red or orange, according to whether it separates from concentrated or dilute alcoholic solutions. It forms salts, which, however, readily dissociate with water. It, further, has the remarkable property of being transformed into a colloid on the addition of water to its solutions in absolute alcohol or acetone. This spontaneously liquefies, with separation of crystals in the course of two or three days. Neither the bromo- nor the nitro-derivatives show this phenomenon.

317. "Electrolytic reduction. Part V. Benzylidene bases." By Herbert Drake Law.

A series of compounds were reduced by the electrolytic method in continuation of similar experiments with the aromatic aldehydes. The results agreed closely with those previously obtained. Two classes of compounds were formed, according to the following general equations:

$$R{\cdot}CH{:}X + 2H = R{\cdot}CH_2{\cdot}XH.$$
$$2R{\cdot}CH{:}X + 2H = R{\cdot}CH(XH){\cdot}CH(XH){\cdot}R.$$

Thus benzylidene-*p*-toluidine yielded benzyl-*p*-toluidine, di-*p*-toluidinodibenzyl, and a green resin. The relative quantity of each constituent varied with the conditions of the experiment, but followed the same rules as those previously given in the case of benzaldehyde. The quantities of each substance formed varied very considerably with a change in constitution. The resin formed diminished as the formula of the reduced substance approached the most symmetrical arrangement of the substituted groups.

318. "The porosity of iron and its relation to passivity and corrosion." By John Albert Newton Friend.

The author showed that: (1) The surface of iron is slightly porous, so that when the metal is immersed in certain solutions the latter are absorbed to a minute extent. (2) The passivity induced by immersion of iron in alkaline solutions, such as those of sodium and potassium hydroxides, is due to absorption of small quantities of these alkalis within the pores of the metal. (3) There are thus more kinds of passivity than one.

319. "Molecular rotatory power in normal homologous series. Part I. Optically active derivatives of the higher aliphatic alcohols and acids." By Thomas Percy Hilditch.

The variation of different types of physical properties in consecutive members of an homologous series was discussed, and it was pointed out that whilst the more additive properties increase in arithmetical progression on ascending such a series, certain essentially constitutive properties tend in these circumstances to arrive at a constant value.

A survey of the existing data on the molecular rotatory powers of optically active homologues shows that here also, although hitherto only the first few members of series of this type have been available, this function nevertheless reaches in many cases an approximately constant figure, characteristic of the optically active series concerned; moreover, those series which do not yield constant values for $[M]_D$ almost invariably contain strongly unsaturated groups.

The author therefore proposes to investigate the homologues of higher molecular weight of some apparently irregular series, in order to determine whether the presence of unsaturation is here a disturbing factor in the lower members. To this end it was necessary in the first place to ensure that, in series the lower members of which rapidly attained constancy of molecular rotatory power, the homologues of high molecular weight should maintain their "series constant" of molecular rotation.

Investigation of the *l*-menthyl esters, and brucine and cinchonine salts of myristic, palmitic, and stearic acids, and of the hydrogen camphorates and camphor-β-sulphonates of cetyl and myricyl alcohols, showed that, within narrow limits, the molecular rotatory powers of the normal aliphatic esters of *l*-menthol, *d*-camphoric acid, and *d*-camphor-β-sulphonic acid, and of the normal aliphatic salts of brucine and cinchonine become numerically constant in each series after the first few members are passed.

320. "Molecular rotatory power in normal homologous series. Part II. The menthyl esters of the α-bromoaliphatic acids." By Harold Christopher and Thomas Percy Hilditch.

The effect of introducing an unsaturated group in close proximity to the carboxyl residue of a series of optically active normal aliphatic esters has been studied by the authors in connexion with the problem of the disturbing effect of unsaturation referred to in the preceding paper.

The α-bromo-derivatives of the aliphatic esters of *l*-menthol were employed in the present investigation on account of the ease with which these compounds may be obtained in the pure condition.

It was found that whilst the first two members of the series (menthyl bromoacetate and α-bromopropionate) possessed molecular rotatory powers markedly above the normal, the anomaly rapidly declined to a minimum, slightly sub-normal value, thereafter rising very much more gradually to an approximately constant value (in the case of menthyl α-bromomyristate and α-bromopalmitate). The final constant molecular rotations appeared to be a very few degrees in excess of those of the corresponding members of the saturated, non-substituted aliphatic menthyl esters.

321. "Note on methyl-*n*-tridecyl- and methyl-*n*-pentadecyl-carbinols and the corresponding ketones." By Robert Howson Pickard and Joseph Kenyon.

In a recent communication (*Trans.*, 1911, **99**, 45) the authors have described the resolution into their optically active components of the members of the series of carbinols from methylethylcarbinol to methyl-*n*-undecylcarbinol. It was intended to continue the series so as to include methyl-*n*-tridecyl- and methyl-*n*-pentadecyl-carbinols, but it has been found that the method of bringing about the resolution of the various members of the series fails in the case of these carbinols, containing fifteen and seventeen carbon atoms respectively. This note contains a short description of the compounds isolated during the course of the experiments, and also shows that the catalytic method with thorium oxide (Senderens, *Compt. rend.*, 1909, **149**, 995) can be used for the formation of ketones, even when they contain many carbon atoms.

Methyl-n-tridecyl Ketone, $CH_3 \cdot CO \cdot C_{13}H_{27}$.—Myristic acid (300 grams) dissolved in glacial acetic acid (2400 grams) was passed at an hourly rate of 50 c.c. through a Jena-glass tube containing thorium oxide, and heated to 400°. The products of the reaction were condensed, dissolved in ether, and washed with a solution of sodium hydroxide until free from acid. Myristic acid (125 grams)

was recovered from the washings, mixed afresh with glacial acetic acid, and again treated. When the products from the two operations were fractionally distilled, 200 grams of methyl-*n*-tridecyl ketone were obtained. The residue in the flask when recrystallised from ethyl alcohol yielded 30 grams of myristone, which melted at 75—76°.

Methyl-n-tridecyl ketone boils at 184°/20 mm., and on cooling sets to a soft mass of crystals, which melt at 37°. It readily forms the *semicarbazone*, which crystallises from ethyl alcohol in needles melting at 126·5°. (Found, N = 15·0. Calc., N = 14·8 per cent.)

Methyl-n-tridecylcarbinol, $CH_3 \cdot CH(OH) \cdot C_{13}H_{27}$, is readily obtained when the corresponding ketone is reduced by sodium in 96 per cent. alcoholic solution, little, if any, pinacone being formed. It boils at 181—183°/19 mm., and on cooling sets to a crystalline mass, which melts at 38—39°.

The *hydrogen phthalate** crystallises from light petroleum in pearly leaflets, and melts at 61—62°. The *brucine* salt crystallises from acetone in needles, which, when dried in the air, melt at 80—85°, but after desiccation in a vacuum or after heating at 105° for a few minutes they melt at 172—175°. After two recrystallisations, on polarimetric examination:

1·0136, made up to 20 c.c. with ethyl alcohol, gave α −6·25°, whence $[\alpha]$ −61·66°.

The *strychnine* salt crystallises from chloroform and acetone in hair-like needles, melts about 130°, and has $[\alpha]_D$ −52·6° when dissolved in chloroform. The hydrogen phthalate obtained from the purest specimen of these salts was in each case found to be quite inactive when examined in the polarimeter.

The *hydrogen succinate* crystallises from light petroleum in nacreous leaflets, which melt at 60—61°. The *brucine* salt is a wax, and unsuitable for fractional crystallisation.

The corresponding derivatives of heptadecane were obtained by similar methods.

Seventy-nine grams of *methyl-n-pentadecyl ketone*,

$$CH_3 \cdot CO \cdot C_{15}H_{31},$$

were obtained from 112 grams of palmitic acid. It boils at 197°/12 mm., crystallises from ethyl alcohol in pearly leaflets melting at 48°, and can be regenerated unchanged from the *semicarbazone*, which crystallises from dilute ethyl alcohol in very small needles melting at 125·5°.

Methyl-n-pentadecylcarbinol boils at 230°/16 mm., forms indefinitely shaped crystals, and melts at 46°. The *hydrogen phthalate*

* The purity of each of the acid esters described in this note was ascertained by titration of their alcoholic solutions with a standard solution of sodium hydroxide.

separates from light petroleum as a mass of needles, which melt at 50—51°. The *hydrogen succinate* separates from light petroleum in a microcrystalline condition, and melts at 64—65°. The *brucine* salts of each of the esters were prepared and recrystallised several times, but no ester could be obtained which exhibited any trace of optical activity.

322. "An experimental investigation of the bleaching process." By Sydney Herbert Higgins.

Solutions of the hypochlorites of lithium, sodium, and potassium prepared from bleaching powder solution by precipitation with solutions of the alkali sulphates or carbonates have identical bleaching properties; the bleaching efficiencies of these solutions are almost equal to that of the original bleaching powder solution. Curves showing (1) the evolution of oxygen from hypochlorite solutions and from solutions of sodium peroxide in contact with copper oxide; (2) the rate of bleaching of solutions of hypochlorites and of sodium peroxide; (3) the rate of oxidation of oxalic acid by potassium permanganate and the rate of liberation of iodine from potassium iodide by acidified sodium peroxide solution (Harcourt and Esson, *Phil. Trans.*, 1866, **156**, 193), point to the conclusion that the actions in all these cases are similar, that is, unimolecular. Hypochlorites therefore bleach because of their readiness directly to produce nascent oxygen. Those substances which accelerate the evolution of oxygen from solutions of hypochlorites or of peroxides also assist the evolution of that gas when they are heated along with potassium chlorate; hence it is taken that the main action in the latter case is a unimolecular one. Chlorine water is a much weaker bleaching agent than solutions of hypochlorites; therefore the bleaching action of the latter cannot be due to the generation of free chlorine as stated by Taylor (*Trans.*, 1910, **97**, 2541). Chlorine water probably owes its bleaching properties to the presence of hypochlorous acid in solution. The proof that the production of chlorine from bleaching powder solution and the stimulation of the bleaching action of that solution have no connexion with one another has led the author to consider the two questions separately. In pursuit of this line of argument he gave further experiments supporting previous conclusions (compare Taylor, this vol., p. 243).

323. "The direct esterification of saturated and unsaturated acids." By Ebenezer Rees Thomas and John Joseph Sudborough.

The esterification of a number of saturated and unsaturated organic acids has been studied by heating the acid with a large

excess of pure ethyl alcohol at 100° in sealed tubes for given periods, and titrating the amount of free acid left.

The results show that an $\alpha\beta$-olefine linking has a retarding effect, except when the unsaturated acid is a very much stronger acid than its saturated analogue, for example, methyl hydrogen maleate, which is some two hundred times as strong an acid as methyl hydrogen succinate. In such a case the olefinic acid is esterified more rapidly than the corresponding saturated acid.

A $\beta\gamma$-unsaturated acid is usually esterified somewhat more rapidly than its saturated analogue, and a $\gamma\delta$-olefinic linking appears to have but little effect on the rate of esterification.

The influence of substituents in both saturated and unsaturated acids is marked.

324. "The influence of three- and four-membered carbon rings on the refractive and dispersive power of organic compounds." By Gustaf Jim Östling.

The molecular refraction and dispersion of several derivatives of *cyclo*propane and *cyclo*butane have been determined and calculated according to the formula:

$$MR = \frac{n^2 - 1}{n^2 + 2} \times \frac{M}{L}.$$

The *cyclo*propane derivatives were tanacetone and its derivatives, esters of carbonic acids, a new hydrocarbon, namely, 1:2-*dimethyl*-cyclo*propane*, and some others. The *cyclo*butane compounds were chiefly esters of various acids.

It was shown that (1) the three- as well as the four-carbon ring exerts an influence on the molecular refraction. The increment in the case of a three-carbon ring is for $M_\alpha + 0{\cdot}67$ and for $M_D + 0{\cdot}71$; in the case of a four-carbon ring for $M_\alpha + 0{\cdot}45$ and for $M_D + 0{\cdot}48$. (2) A small exaltation is noticeable when the three-carbon ring is conjugated with a double bond ($E\Sigma_D = + 0{\cdot}2$). (3) The three- and the four-carbon rings have practically no influence on the molecular dispersion. (4) The conjugation of a three-carbon ring and a double bond increases the molecular dispersion about 10 per cent.

The magnetic rotation for a saturated tricyclic terpene, β-pinolene, has also been determined.

325. "Contributions to our knowledge of semicarbazones." (Preliminary note.) By Isidor Morris Heilbron and Forsyth James Wilson.

In the course of some recent experiments the authors observed that *m*-nitrobenzylidenedeoxybenzoin on treatment with semicarb-

azide acetate formed two distinct semicarbazones, a colourless and a yellow modification. The addition of sodium hydroxide solution to an alcoholic solution of either the colourless or the yellow form produced an intense yellow coloration, which was destroyed by acids.

As semicarbazones have not as yet been very fully studied, the authors are extending their observations to semicarbazones derived from both saturated and unsaturated ketones and aldehydes.

Phenyl styryl ketone gives on direct treatment with semicarbazide acetate two distinct semicarbazones: a colourless form, melting at 168°, which is rapidly precipitated from a dilute alcoholic solution, and a more soluble yellow form obtained by dilution of the mother-liquors. On attempting to recrystallise this yellow modification from chloroform, the authors found that it passes into a third modification, which crystallises in colourless, silky needles melting at 180°. This semicarbazone in the dry state is unstable, being gradually reconverted on exposure to diffused sunlight into the yellow modification. No melting point for this yellow form can be obtained, as it passes when heated above 160° into the colourless modification melting at 180°. Alcoholic solutions of both colourless semicarbazones give with sodium hydroxide intensely yellow products, which are still under investigation.

The absorption spectra of these various semicarbazones are being investigated in the hope of throwing further light on the subject.

It has also been found that semicarbazones of both saturated and unsaturated aldehydes and ketones are affected by ultraviolet light, stereoisomerides being apparently produced in some cases, decomposition products in others. Investigations in this direction are also in progress.

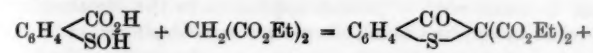
326. "Conductivity and dissociation of diacetyltartaric acid." By Stella Deakin and Albert Cherbury David Rivett.

Diacetyltartaric anhydride is hydrated too rapidly for the course of the action to be followed by the conductivity method (compare Rivett and Sidgwick, *Trans.*, 1910, **93**, 732, 1677). Since some connexion appears to exist in such a case between rate of hydration and first dissociation constant of the acid, a determination of the latter was desirable, and has been made, giving the value $2{\cdot}5 \times 10^{-2}$, a higher figure than is given by the acid corresponding with any anhydride the rate of hydration of which has been measured. The second dissociation constant approximates to $0{\cdot}11 \times 10^{-2}$.

327. "A synthesis of 'thioindigo.'" (Preliminary note.)

By William George Prescott and Samuel Smiles

When *o*-thiol- or *o*-dithio-benzoic acid is treated with malonic acid or its ester in the presence of warm concentrated sulphuric acid a vigorous reaction occurs, and "thioindigo" is formed. From preliminary experiments the yield of the latter substance appears to be as high as about 85 per cent. of the theoretical, exclusive of thioindigosulphonic acid which is simultaneously produced. Traces of hydroxybenzothiophen were also isolated. There is no doubt that the preliminary stage of the interaction depends on the formation of the sulphoxylic acid (*Trans.*, 1911, **99**, 640), which then reacts as follows:

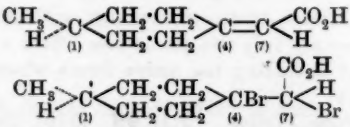


Condensation of these thio-acids with ethyl acetoacetate, substituted malonic acids, and similar substances may also be effected; these interactions are now being more closely investigated.

328. "Asymmetry in the supposed absence of an asymmetric atom."

By James Ernest Marsh.

Everest's paper (this vol., p. 285) disposes effectively of the claim that a new type of asymmetry exists which is not dependent on the presence of an asymmetric atom in the molecule. At the same time the views of Everest involve him in a difficulty of another kind: in the conversion of the unsaturated acid into its dibromide, the asymmetric carbon atom (1) is represented as losing its asymmetry, while a new asymmetric carbon atom (7) is created in a different part of the molecule outside the ring:



Perkin, Pope, and Wallach, in stating (*Proc.*, 1909, **25**, 83) that the constitutional formula of the unsaturated acid "comprises no atom which can be described as asymmetric, no matter which definition of an asymmetric atom be adopted," have overlooked the definition given by the author (*Phil. Mag.*, 1888, [v], **26**, 426). He there defined an asymmetric carbon atom as one which, when replaced by its image, gives a formula different from the original formula. This idea involved the consideration of an atom isolated from the

rest of the molecule, and was justified in view of van't Hoff's theory (*Dix Années*, etc., 1887, pp. 27 and 28) that the tetrahedron the centre of which is occupied by the carbon atom acquires an asymmetric form owing to the effect of four different affinities on it; thus the asymmetrically deformed atom can be considered apart from the particular groups to which it is attached. The groups may be four or less, according as the atom is situated in open-chain or in one or more rings. The atom being asymmetric will have a non-superposable image. The replacement of the atom by its image was represented in the author's paper as brought about by an exchange of position of two of the groups attached to the atom. The same inversion may be done by flyping the tetrahedron (that is, by turning it inside out), a process applicable to the stereocentric benzene formulæ, and one which affords a simple explanation of the phenomenon called the Walden inversion. In this method of treatment there is no need for a kind of dissection of a formula, as employed by Everest to prove four different groups, a process which must become difficult when there are several asymmetric atoms in the molecule. The views expressed in the author's paper lead to the conclusion that the methyl*cyclo*hexylideneacetic acid has three asymmetric carbon atoms in the molecule (1), (4), and (7), and that all three remain asymmetric in the bromine additive compound.

The exchange of position of any two groups or linkings attached to C (1) in either acid gives a formula different from the original one, being, in fact, that of the optical isomeride. The case is the same with C (4) and C (7). The unsaturated acid is certainly a compound of a novel type, in that with three asymmetric carbon atoms there are only two possible isomerides, and those enantiomorphous.

A somewhat similar example of a limited isomerism is that of the trihydroxyglutaric acids, where also with three asymmetric carbon atoms there are only two isomerides which are here optically inactive (without including the active forms which have only two asymmetric atoms).

Perkin and Pope (*Trans.*, 1911, **99**, 1510) claim that in the methyl*cyclo*hexylideneacetic acid "the optical activity is due to the enantiomorphous configuration of the molecule as a whole." This is certainly true, not only of this acid, but of every optically active substance whatever, and the author stated it in the paper already mentioned. The converse has also proved true that unless the molecule as a whole is asymmetric it will be optically inactive, however many asymmetric atoms it may contain. The term "centroasymmetry" is therefore not only unnecessary, but misleading; and van't Hoff's original proposition with regard to carbon

still holds good, that every optically active compound has an asymmetric atom in the molecule, although the presence of asymmetric carbon does not necessarily involve optical activity.

329. "Latent heats of vaporisation of mixed liquids. Part II." By Dan Tyrer.

In continuation of previous investigations (*Trans.*, 1911, **99**, 1633) it was pointed out that a mixture of two liquids has really two latent heats, namely, (1) heat absorbed when 1 gram of the mixture vaporises at constant temperature and pressure from an infinitely large quantity of the mixture of known composition. It is supposed that no change in the composition occurs in this process. (2) Heat absorbed when 1 gram of a mixture is completely vaporised at constant temperature. If x is the composition of the liquid in (1) and y the composition of the vapour which leaves it, and if y is also the composition of the 1 gram of liquid in (2), then it can be easily shown that:

$$(Lp)_x = (Lc)_y + H,$$

where Lp and Lc are the two latent heats respectively defined above, and H is the heat developed when 1 gram of the mixture of composition y is added to an infinitely large quantity of the liquid of composition x. Values of Lp for several mixtures have been experimentally determined, and also the compositions y of the vapour boiling off from mixtures of known compositions, and from this data values of Lc have been calculated. It was shown that whilst the results for Lp do not appear to bear any simple relation to the compositions of the mixtures, those for Lc follow Trouton's equation:

$$L_c M / T = \text{constant},$$

where M is the mean molecular weight of the mixture and T is the temperature.

330. "Influence of double linking on optical activity." By Percy Faraday Frankland and Hugh Henry O'Sullivan.

The authors have compared the relative rotatory effects of the allyl and *n*-propyl groups in the following pairs of compounds:

	In liquid state. $[M]_D^{20°}$.
Menthoxyacetic allylamide	−192·5°
Menthoxyacetic *n*-propylamide	193·7
Allyl menthoxyacetate	234·4
n-Propyl menthoxyacetate	234·1
Menthyl allylaminoacetate	160·5
Menthyl *n*-propylaminoacetate	158·3

The differences in molecular rotation are thus very small; indeed, in the case of the allyl and propyl menthoxyacetates the allyl has slightly the higher rotation at low temperatures and the propyl compound at high temperatures.

In the case of the allyl- and propyl-amides of tartaric and malic acids previously investigated by one of the authors (*Trans.*, 1906, **89**, 1854 and 1861), the differences in rotation were much more pronounced, and in both instances the propyl compound had the higher rotation, thus:

	In pyridine solution.	
	$[M]_D^{20°}$. Tartaric.	$[M]_D^{20°}$. Malic.
Allylamide.....	+251°	−72·7°
n-Propylamide	+289	−90·5

These greater differences in rotation in the case of the tartaric and malic compounds are probably due to there only being three intervening atoms between the unsaturated and the asymmetric carbon atoms, whilst in the above menthyl compounds there are in all cases five intervening atoms between the unsaturated carbon atom of the allyl and the nearest asymmetric carbon of the menthyl group.

331. "The action of aliphatic amines on *s*-dibromosuccinic acid. Part I." By Edward Percy Frankland and Henry Edgar Smith.

The authors have prepared the dipropylamino- and dibutylamino-succinic acids, $\begin{matrix} R\cdot NH\cdot CH\cdot CO_2H \\ R\cdot NH\cdot CH\cdot CO_2H' \end{matrix}$ by the action of *n*-propylamine and *n*-butylamine respectively on *s*-dibromosuccinic acid in alcoholic solution. The reaction appears to proceed in a manner analogous to that described by E. P. Frankland (*Trans.*, 1911, **99**, 1775) in the case of benzylamine and *s*-dibromosuccinic acid. The alkylamino-acids yield copper salts, hydrochlorides, and dinitroso-derivatives.

332. "The velocity of the reaction between iodic and sulphurous acids in various media." By Thomas Stewart Patterson and William Collins Forsyth.

The influence of methyl alcohol, ethyl alcohol, *n*-propyl alcohol, and of acetone on the velocity of the reaction between iodic acid and sulphurous acid was described.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Braccesco, *Giovanni.* La espositione di Geber Filosofo . . . , nella quale si dichiarano molti nobilissimi secreti della Natura. In Vinegia appresso Gabriel Giolito dé Ferrari 1562. pp. 160. (*Reference.*)
From Dr. J. N. Goldsmith.

Dunstan, *Albert Ernest,* and **Thole,** *Ferdinand Bernard.* Textbook of practical chemistry for technical institutes. pp. viii + 335. ill. London 1911. (*Recd.* 16/11/11.)
From the Publishers: Messrs. Methuen & Co., Ltd.

Espagnet, *Joannes d'.* Das Geheime Werck der Hermetischen Philosophie, Worinnen die natürlichen und künstlichen Geheimnüsse der Materie des Philosophischen Steins, wie auch die Art und Weise zu arbeiten richtig und ordendlich offenbahret sind. pp. [xii] + 90. [Wanting pp. 37–38, 71–72 and 87–88.] Leipzig 1685. (*Reference.*)
From Dr. J. N. Goldsmith.

Royal Society of London. Catalogue of a collection of early printed books in the Library. pp. 120. London 1910. (*Recd.* 20/11/11.)

II. *By Purchase.*

Barthel, *Chr.* Methods used in the examination of milk and dairy products. Translated by *W.* **Goodwin.** pp. xi + 260. ill. London 1910. (*Recd.* 20/11/11.)

Blount, *Bertram,* and **Bloxam,** *Arthur George.* Chemistry for engineers and manufacturers. 2nd edition. 2 vols. pp. xii + 392, xv + 513. ill. London 1911, 1910. (*Recd.* 17/11/11.)

Böttger, *Wilhelm.* Stand und Wege der analytischen Chemie. (Die chemische Analyse, Vol. XIII.) Stuttgart 1911. (*Recd.* 24/11/11.)

Höber, *Rudolf.* Physikalische Chemie der Zelle und der Gewebe. 3rd edition. pp. xv + 671. Leipzig 1911. (*Recd.* 25/11/11.)

Rideal, *Samuel.* Disinfection and the preservation of food. Together with an account of the chemical substances used as antiseptics and preservatives. 3rd edition. pp. xii + 494. ill. London 1903. (*Recd.* 17/11/11.)

Ubbelohde, *L.,* and **Goldschmidt,** *F.* Handbuch der Chemie und Technologie der Öle und Fette. Vol. III, part 2. pp. xiv + 381 to 1195. ill. Leipzig 1911. (*Recd.* 24/11/11.)

At the next Ordinary Scientific Meeting on Thursday, December 21st, 1911, at 8.30 p.m., the following papers will be communicated:

"Investigations on the dependence of rotatory power on chemical constitution. Part II. The rotations of some secondary alcohols containing the *iso*propyl group." By R. H. Pickard and J. Kenyon.

"The alcohols of the hydroaromatic and terpene series. Part II. The menthols corresponding with optically inactive menthone." By R. H. Pickard and W. O. Littlebury.

"The absorption spectra of quinine, cupreine, 6-methoxyquinoline and 6-hydroxyquinoline." By J. J. Dobbie and J. J. Fox.

R. CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.

[*Issued* 30/12/11

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 27. No. 394.

Thursday, December 21st, 1911, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. Hugh Marshall and C. H. K. Gonville were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Fred Barrow, M.Sc., Ph.D., Birkbeck College, Bream's Buildings, E.C.

David Brownlie, B.Sc., 41, Corporation Street, Manchester.

Thomas Alfred Brunjes, 49, St. Donatts Road, New Cross, S.E.

Sidney Waterfield Bunker, B.Sc., 30, York Street, Twickenham.

Tom Peach Colclough, M.Sc., 47, Vicar Lane, Woodhouse, Sheffield.

Cornelius Durham Garbutt, 2, Hartington Road, Garston, Liverpool.

Jyotish Chandra Ghosh, 105, M. C. Ghosh's Lane, Howrah, India.

Richard Ernest Gibbins, Clytha, Quinton Road, Coventry.

Rupert William Pope, B.Sc., 10, Malpas Road, Brockley, S.E.

Howard Vincent Potter, Rosemount, Pollard Road, Whetstone, N.

Alfred Reginald Roberts, c/o Canada Cement Co., Shallow Lake, Ontario.
Richard Smith, 6, Essex Road, Gorton, Manchester.
John Kerfoot Wood, D.Sc., 7, Airlie Terrace, Dundee.

A certificate has been authorised by the Council for presentation to ballot under Bye-Law I (3) in favour of John Duncan, Victoria Street, Waterloo, Sydney, N.S.W.

The PRESIDENT announced that the Longstaff Medal (1912) had been awarded to Dr. H. Brereton Baker, F.R.S.; the actual presentation would be made at the Annual General Meeting of the Society in March, 1912.

Of the following papers, those marked * were read:

***333. "Investigations on the dependence of rotatory power on chemical constitution. Part II. The rotations of some secondary alcohols containing the *iso*propyl group." By Robert Howson Pickard and Joseph Kenyon.**

The authors have continued their investigations (*Trans.*, 1911, **99**, 45), and six alcohols of the general formula

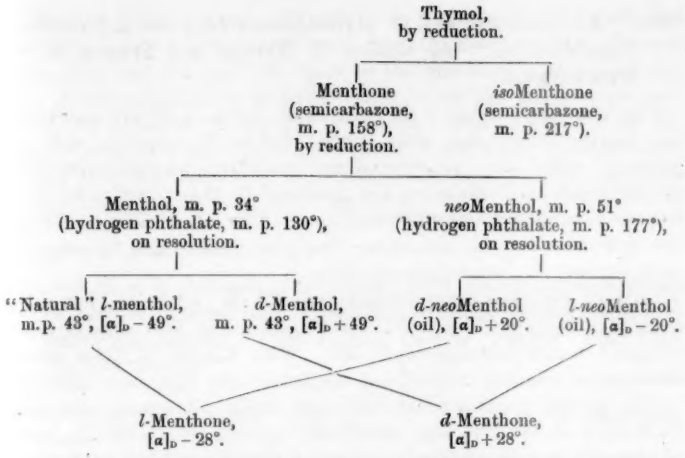
$$CHMe_2{\cdot}CH(OH){\cdot}R,$$

where R = methyl, ethyl, *n*-propyl, *n*-amyl, *n*-hexyl, or *n*-octyl, were described.

The specific rotations at 20° of the dextrorotatory forms of these alcohols are: *Methyl*isopropylcarbinol, $[\alpha]_D + 4{\cdot}8°$; *ethyl*isopropylcarbinol, $[\alpha]_D + 15{\cdot}1°$; *propyl*isopropylcarbinol, $[\alpha]_D + 21{\cdot}2°$; n-*amyl*isopropylcarbinol, $[\alpha]_D + 22{\cdot}7°$; n-*hexyl*isopropylcarbinol, $[\alpha]_D + 21{\cdot}5°$, and n-*octyl*isopropylcarbinol, $[\alpha]_D + 18{\cdot}5°$.

***334. "The alcohols of the hydroaromatic and terpene series. Part II. The menthols corresponding with optically inactive menthone." By Robert Howson Pickard and William Oswald Littlebury.**

The authors described an investigation of the relationship existing between the menthols produced by the reduction of one of the two optically inactive stereoisomerides, which have the formula $CHMe\langle\begin{matrix}CH_2{-}CO\\CH_2{\cdot}CH_2\end{matrix}\rangle CHPr^{\beta}$. The following diagram shows the results obtained:



d-*neo*Menthol was found in some residues, which were kindly presented to the authors by Messrs. Schimmel & Co., who obtained the same after working up large quantities of Japanese peppermint oil for *l*-menthol.

***335. "The absorption spectra of quinine, cupreine, 6-methoxyquinoline, and 6-hydroxyquinoline." By James Johnston Dobbie and John Jacob Fox.**

In a paper dealing with the absorption spectra of cinchonine, quinine, and their isomerides (*Trans.*, 1911, **99**, 1254), it was shown that the absorption spectra of cinchonine and quinoline are practically identical, the reduced half of the cinchonine molecule having little effect on the spectrum. The absorption spectra of quinine and cupreine have now been compared with those of 6-methoxyquinoline and 6-hydroxyquinoline, with similar results.

The four spectra resemble one another very closely. They exhibit three bands each, the principal band having its head at about $1/\lambda 3050$, and the two others at about $1/\lambda 3500$ and $1/\lambda 3750$ respectively. The chief difference between the spectra of quinine and cupreine on the one hand, and those of methoxyquinoline and hydroxyquinoline on the other, lies in the somewhat greater absorption exhibited by the alkaloids. The hydrochlorides of quinine and 6-methoxyquinoline also yield absorption spectra which are nearly identical. Those given by $N/100$-solutions of quinine sulphate and methoxyquinoline sulphate (both fluorescent solutions) differ only in the greater general absorption of the former.

***336. "Amino-derivatives of arylsulphonanilides and arylsulphon-β-naphthalides." By Gilbert T. Morgan and Frances M. G. Micklethwait.**

The toluene-*p*-sulphonyl derivatives of the *m*- and *p*-nitroanilines are readily methylated with methyl halides in alcoholic soda or potash, and the corresponding as-*toluene*-p-*sulphonylmethyl*-m(and p)-*phenylenediamines* are produced by the reduction of these toluene-*p*-sulphonylmethylnitroanilines. The diazonium salts of the new bases furnish azo-colours dying on wool or silk by coupling with various naphtholsulphonic acids.

Toluene-*p*-sulphon-β-naphthalide yields on nitration, not only toluene-*p*-sulphonyl-1-nitro-β-naphthylamine, but also *toluene*-p-*sulphonyl*-1 : 6-*dinitro*-β-*naphthylamine*. The former of these nitro-derivatives is readily methylated, the latter only with some difficulty.

The amines produced by reducing these nitro-compounds and their alkyl derivatives were described, together with a similar series of compounds derived from β-naphthylamine-6-sulphonic acid.

337. "The action of nascent hydrogen on nitric acid." By Manindra Nath Banerjee and Satish Chandra Banerjee.

Veley, in explaining the action of nitric acid on metals (*Proc. Roy. Soc.*, 1890, **46**, 216; 1893, **52**, 27; *Phil. Trans.*, 1891, *A*, 312; *J. Soc. Chem. Ind.*, 1891, **10**, 204), states that the action is due to nitrous acid and to its mass present in the solution. He believes that the action is started with mere traces of nitrous acid, always present in the original acid. He is not in favour of the nascent hydrogen theory advanced by certain chemists. The authors find that nascent hydrogen has rapid action on nitric acid, first decomposing it (acting catalytically), and then reducing it to the lower oxides of nitrogen, and finally to ammonia. This argument has been further extended to explain the action of nitric acid on metals, in which the authors have attempted to prove that it is the nascent hydrogen, and not nitrous acid, that is responsible for the formation of various reduction products. The reaction is found to depend entirely on the capacity of metals to decompose water, and the authors confirm the views of Montemartini as to the relation of the action of nitric acid on metals to that of metals on water (liberating hydrogen), namely, that those metals which decompose water at a high temperature give with nitric acid, nitrogen peroxide, trioxide, and dioxide; whilst those that decompose water at a low temperature give, in addition to the above, nitrous oxide, nitrogen, and ammonia; and, lastly, those decomposing water at the ordinary temperature also evolve hydrogen.

Nascent hydrogen was obtained from platinum-black which had occluded the gas. The experiments showing the interaction between nitric acid and the platinum-black on the one hand, and the absorption of the products by suitable reagents on the other, were conducted in a suitably arranged apparatus. The interaction of the nascent hydrogen and nitric acid results in the ready decomposition of the acid and formation of various reduction products, the free oxygen being wholly converted into water.

338. "Studies in the camphane series. Part XXXI. Condensation of camphorquinone with nitromethane, ethyl cyanoacetate, and phenylacetonitrile." By Martin Onslow Forster and John Charles Withers.

Nitromethylenecamphor, $C_8H_{14}<\begin{matrix}C{:}CH\cdot NO_2\\ |\\ CO\end{matrix}$, prepared from camphorquinone and sodionitromethane in alcohol, melts at 77°, and is immediately resolved into its factors by warm aqueous alkali; under certain conditions it is accompanied by *nitromethylhydroxycamphor*, $C_8H_{14}<\begin{matrix}C(OH)\cdot CH_2\cdot NO_2\\ |\\ CO\end{matrix}$, which melts at 104°, and also gives camphorquinone with hot alkali hydroxide. *Ethyl camphorylidenecyanoacetate* (*ethyl methylenecamphorcyanocarboxylate*),

$$C_8H_{14}<\begin{matrix}C{:}C(CN)\cdot CO_2\cdot C_2H_5\\ |\\ CO\end{matrix},$$

produced by the influence of sodium ethoxide (0·05 mol.) on an alcoholic mixture of camphorquinone and ethyl cyanoacetate, forms lustrous, sulphur-yellow prisms, melting at 97°. The corresponding *acid*, $C_{13}H_{15}O_3N$, melts at 141—143°, and the *methyl* ester, $C_{14}H_{17}O_3N$, at 81°. *Phenylcyanomethylenecamphor*,

$$C_8H_{14}<\begin{matrix}C{:}C(CN)\cdot C_6H_5\\ |\\ CO\end{matrix},$$

obtained from camphorquinone and phenylacetonitrile with a small proportion of sodium ethoxide, crystallises in massive, yellow prisms, melting at 166°.

When ethyl camphorylidenecyanoacetate is treated with hydrogen peroxide, hydrolysis of the cyano-group takes place simultaneously with oxidation. The resulting *amide-ester*, $C_{15}H_{21}O_6N$, melts at 209°, and is accompanied by the *amide-acid*, $C_{13}H_{17}O_6N,H_2O$, melting at 205°. Both substances, on complete hydrolysis, yield the dibasic *acid*, $C_{13}H_{16}O_7$, which melts at 231°.

339. "Solutions of halogen double salts in water and ether." By James Ernest Marsh.

The capability of the halogen double salts to give homogeneous solutions in a mixture of ether and water is limited, on the one hand, by the too great solubility of the salt in one of the solvents, and on the other by the too slight solubility of the salt in both solvents. Sodium, potassium, rubidium, and barium mercuri-iodides give with ether and water homogeneous solutions, which on warming separate into three layers; the lithium and ammonium salts are very soluble in ether with a little water, and leave the excess of water undissolved; the cæsium salt is only sparingly soluble, and has but little effect on a mixture of ether and water. Of the bromides, ammonium mercuribromide, and of the chlorides, lithium mercurichloride are the only inorganic salts of this sort which have been found to give homogeneous solutions, separating on warming into three layers. Potassium mercurichloride resembles cæsium mercuri-iodide, and has but little action. So far as they have been examined, the salts of primary amines resemble the salts of ammonium, whilst tetramethylammonium mercuri-iodide resembles the cæsium salt, and has even less action.

340. "The relation between the absorption spectra of metallic ions and their valency." By Cecil Reginald Crymble.

The absorption spectra of the aqueous solution of more than thirty metals have been examined. It has been found that the metals of constant valency give solutions which are non-absorptive provided that a salt is employed, the acidic radicle of which is itself diactinic. On the other hand, the metals which vary in valency yield absorptive solutions. A connexion has also been shown to exist between the absorptive properties of solution of metals and the chemical and physical properties of the metals.

341. "The solubility of electrolytes in aqueous solutions. Part II. Solubility of oxalic acid in other acids." By James Irvine Orme Masson.

In extension of previous work, which dealt with salts in acid solution (Trans., 1911, **99**, 1132), measurements have been made of the solubility at 30° of oxalic acid in solutions of nitric and of hydrochloric acids.

In both cases the solubility falls to a minimum as the concentra-

tion of solvent acid rises, after which it increases. In nitric acid solutions this increase is terminated by conversion of the solid oxalic acid into the anhydrous compound, the solubility of which then falls to a second minimum. The concentration of nitric acid at the transition point is about that of "constant boiling point" acid.

The solubility curves of the dihydrate in both acids are conic in form, and in this respect resemble certain other solubility curves.

The assumption of constant molecular volume in solution, which was found to be valid in the earlier cases studied, holds also in these instances.

Supplementary determinations were made with β-naphthalene-sulphonic acid in hydrochloric acid solution. The curve obtained resembles those for the salt-acid examples.

342. The determination of sulphur in petroleum." By James McConnell Sanders.

The Mahler or Hempel calorimetric bomb method for estimating the total sulphur in petroleums, although trustworthy, is somewhat lengthy, since the gaseous combustion products must be absorbed, and when samples poor in sulphur are under treatment, several combustions must be made. The Parr calorimeter is not available for petroleums on account of the small amount of sample which can be treated.

The author described a method by which a large sample may be concentrated by treatment with fuming nitric acid and potassium bromide, the product being absorbed by magnesium oxide, which enables it to be readily removed from the concentrating dish, and burnt in the Parr apparatus with sodium peroxide. Several samples may be treated simultaneously, the final combustion taking about forty-five seconds.

Test analyses were given, comparing results with the Mahler bomb method. For samples poor in sulphur a modified lamp method was described, in which a larger sample is completely burnt, thus avoiding the errors in the usual method owing to the sulphur being given off in an irregular manner.

Some Mexican and Texan kerosenes contain loosely combined sulphur, which decomposes when heated or when in contact with some metals, such as copper; since samples have been known to blister, and even perforate, a copper lamp, the testing of commercial kerosenes for such unstable sulphur was recommended. The author described a qualitative and quantitative method for the purpose.

For the manipulation of the small precipitates of barium sulphate obtained in these operations, the author described a rapid suction-

filter method, in which the amount of filter-paper is reduced to a minimum, and the weighing conducted in a very light dish. For the simultaneous treatment of several precipitates a special arrangement of the apparatus was described.

ADDITIONS TO THE LIBRARY.

II. *By Purchase.*

Nernst, *Walter.* Theoretical chemistry from the standpoint of Avogadro's rule and thermodynamics. Revised in accordance with the sixth German edition by *Henry Thomas* **Tizard.** pp. xix + 810. London 1911. (*Recd.* 16/12/11.)

Schidrowitz, *Philip.* Rubber. pp. xv + 303. ill. London 1911. (*Recd.* 20/12/11.)

Weimarn, *P. P. von.* Grundzüge der Dispersoidchemie. pp. viii + 127. ill. Dresden 1911. (*Recd.* 16/12/11.)

The next Ordinary Scientific Meeting will be held on **Thursday, January 18th,** 1912, at **8.30** p.m.

R. CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.